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ORIGINAL RESEARCH PAPER

ETHICAL ISSUES IN THE APPLICATION OF NEUROMARKETING RESEARCH

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ABSTRACT

Namely, neuromarketing represents a branch of the application of neuroscience for marketing purposes and a modern method of studying brain reactions during marketing messages or consumer behavior. As an interdisciplinary science, it relies on the knowledge of a number of sciences: psychology, neurology, consumer psychology, neuropsychology, medicine, biology, marketing, but also the knowledge gained by sharing with them. It proved to be a more advanced method of marketing research than conventional (classical, traditional) techniques and methods (surveys, interviews, focus groups, stakeholders, etc.). Neuromarketing represents the application of neuroscience studies in the knowledge and explanation of subconscious dispositions of consumer behavior. For this purpose, it uses various brain scanning methods, techniques and devices that determine the brain reactions of consumers to marketing stimuli or certain products/services. Functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) are most commonly used. In this sense, the main goal of this work is to indicate the possibilities of practical application of the techniques and methods used by neuromarketing. By following the reactions of certain parts of the brain and knowing their basic psychological functions, researchers and marketing experts are able to determine the type of psychological process (emotion) that occurs due to a certain stimulus. As a new theoretical concept of consumer behavior research, it causes many controversies and ethical dilemmas.

Keywords: neuromarketing, ethics, persuasive communication, marketing, consumer awareness

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1. Introduction

Advertising, that is, all elements of marketing, with their own, specific functions, tasks and goals, strive to inform consumers about products and services on the market. The study of consumer behavior as a special marketing field began when manufacturers realized that consumers do not always react and behave in accordance with their expectations. Marketers have realized that, if they want to find an answer to the question that bothers them - why consumers choose one brand and not another, they definitely have to take into account the environmental changes in which the consumer acts and, accordingly, the reactive and adaptive changes in his behavior. It was this realization, but also the fact that most consumer decisions actually take place on a completely unconscious level, and therefore inaccessible to marketers, that created the need for new market research methods that want to offer more reliable and precise data on consumer behavior as a basis for better business decisions. Bearing in mind that today there are more and more advertisements that try to attract the attention of consumers through the media, one cannot help but notice that advertisements, along with journalistic texts, have become a large integral part of the media, and many media survive precisely because of advertisements. The advertising apparatus and the advertising industry often use manipulations in order to "persuade" the audience to buy and use the advertised product or service, so the question arises about the ethics and truthfulness of advertisements.

In the case of persuasive communication, the sender necessarily represents a certain party; has a goal that is usually not the same as the recipient's. Persuasive messages created in the field of behavioral economics, neuroeconomics and neuromarketing are designed in a way that subtly but aggressively forces the receiver to understand the code that is in the interest of the sender, which raises the question of the ethics of such a way of communication.

The initial part of this work places behavioral economics, neuroeconomics and neuromarketing in a broader context, the latter discusses the ethical problems that the mentioned areas face in their activity. In the context of research activity, we deal primarily with the participant's right to adequate information about the research, his right to autonomy when deciding on his participation, and the right to security, privacy and dignity, which the use of neuroeconomic and neuromarketing techniques often endangers.

2. Persuasive communication in marketing communication methods and techniques

In modern marketing communication, until recently, models prevailed that assumed that people make decisions guided solely by reason and that, accordingly, the final decision to buy a product is determined by the expected benefit that the consumer has from it (Kahnemann, 2003). In this case, the processing of information about the product and the subsequent decision making on the exchange of goods is slow, deliberate, and in accordance with logical rules. Such models, however, cannot explain the results of a series of studies (Plassman et al., 2011) which showed that a large number of factors, both related and unrelated to the product itself, often modulate the probability of purchase. Behavioral economics, neuroeconomics and neuromarketing appear as an answer. According to Aronson (2005), when choosing a product, people often use mental shortcuts or heuristics, based on previously created schemas, as well as emotional reactions to the product, brand or persuasive message, in addition to rational argumentation. Such decision-making methods, in order to save energy and time, do not take into account all options, but on the basis of evolutionarily or experientially the most efficient patterns direct the selection process towards the solution that is the most efficient on a probabilistic level. In this case, information processing takes place automatically, quickly, effortlessly, intuitively, emotionally, and often independently of language or other symbolic material, and thus the rules of logic (Aronson, 2005).

Accordingly, previous market research was based on survey, interview or focus group methods, which as self-report measures are able to investigate only conscious, rational aspects of decision-making (Morin, 2011). Since a large part of information processing takes place at the already mentioned lower, unconscious levels that do not know how to resonate at the level of symbols and in accordance with the rules of logic, Aronson (2005) states that today in the field of behavioral economics they have been supplemented by ingenious research that takes into account the irrational nature human and study the aforementioned factors that model and influence human consumer behavior on an unconscious level, such as common patterns, schemes and heuristics when making decisions. In

the field of neuroeconomics and neuromarketing, techniques such as brain imaging (fMRI, PET, EEG) and physiological measures (heart rate, breathing rate and galvanic skin reaction) are used, which gives insight into people's unique experience of a certain stimulus, in this case persuasive messages.

3. A new way of shaping consumer brand awareness

Globalization, i.e. the establishment of the neoliberal capitalist system at the global level at the end of the twentieth century, stimulated significant economic, social and political changes, which at the same time led to the expansion of the market-profit matrix to those areas of human activity that were not previously the primary focus of its interest. The period was marked by the trends of increased trade exchange and ruthless competition, increased and accelerated flow of capital, strong development of information technologies, adapted production systems, races and struggles for constant growth and market expansion, accelerated growth of international marketing, which led to changes in social systems, ways of life, models of behavior and governance (Jagić & Vučetić, 2013, p.15). Globalization creates a completely "new competitive landscape" characterized, among other things, by "extreme" consumer demands, and thus by hyper-competition and increased demands for innovation (Hit & DeMarie, 1998, p. 22, according to Zdrilic, Puvača and Roso, 2010, p. 507) . The technological development of information technology, together with the increased use of the Internet in the last two decades, has fundamentally transformed market research. This development has accelerated in the last five years due to the rapid expansion of social networks and improved data analytics techniques (Probst et al., 2014, p. 3).

All business systems today operate in a very changing environment, which has led to their need for adaptation through more intensive thinking about ways to achieve competitive advantage. It can thus be noted that consumers once upon a time, when the rhythm of life was much slower and calmer and before there was such a saturation of the advertising market, were not bothered by "marketing intrusions", such as, for example, promotional campaigns that would interrupt their viewing of their favorite series. However, today we are witnessing a fast, continuous and ever-changing media onslaught, where the Internet with its pop-up ads and banners, cable television, e-mails, text messages and other platforms compete for consumer attention. Times have changed, and today mass marketing techniques and tools are used for specially profiled purposes and company strategies. Companies are making more and more efforts to gain loyalty to the brand, that is, to the product and to gain the trust of customers. Until recently, the economy was dominated by models that assumed that people make decisions guided solely by reason and that, accordingly, the final decision to purchase a product is determined by the expected benefit that the consumer has from it (Kahnemann, 2003).

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on an unconscious level, such as common patterns, schemes and heuristics when making decisions. The goal of the company's business is to get to know consumers, build an emotional relationship with them and nurture that relationship over a long period of time. In other words, modern marketing puts the consumer in the center of attention as the goal towards which all activities of producers, market institutions and marketing activities are directed.

Namely, the shift from mass production and general, mass marketing also meant a shift away from the orientation towards sales and closer to the consumer, which resulted in the creation of a whole not marketing called "Consumer behavior" which is nothing but a happy combination of psychology and marketing (Milas, 2007, p. 22-23). "Consumer behavior is the study of how individuals, groups, and organizations select, purchase, use, and dispose of goods, services, ideas, or experiences to satisfy their own needs and wants. The study of consumer behavior as a special marketing area begins when producers realized that consumers do not react and do not always behave in accordance with their expectations" (Babić, 2016, p. 155). Therefore, mass marketing as well as its traditional research methods are no longer up to the task of finding answers to the question of what consumers really think and want, and Lindstrom sees the reason for this in the fact that our unconscious mind is flooded with subconscious factors such as cultural prejudices rooted in our culture , education, has a powerful and hidden influence on our decisions (cf. Lindstrom, 2012, p. 27). "If they made a 'cook book' that would give answers to the questions of why some product brands succeed and others fail, it would help us to better understand what really happens in our brain when we make a decision whether to buy something or not" (Schola, 2016, p. 21).

The challenge for marketing experts, given the ever-shrinking difference in quality and with all the technology, becomes all the greater considering that it has been proven that ninety percent of consumers make their final purchase decisions exclusively on an unconscious level and within just four seconds (Šola, 2012, p. 49) and that only eleven percent of purchases take place on the basis of conscious or explicit decisions, which speaks in favor of the fact that man is not a rational being (Babić, 2016, p. 55). Caldeira de Oliveira at all, (2015, p. 10) base their study on the fact that the same ethical principles of ethics cannot be applied in different branches and ethical codes must be adapted to each individual industry. Our "conscious brains", that is, the part of our thinking where we are conscious of thinking, can only at best process forty bits of information per second, while everything else is processed subconsciously. This represents a ratio of 99.99% subconscious in conscious processing (Pradeep, 2010, p. 4). The winner of the Nobel Prize Daniel Kahneman explains this statement in the way that consumers have two parallel systems in their minds - one for action and one for thinking. In the first part, we find memories of past sensory stimulation (such as advertisements, shopping and consumption experiences, word of mouth, etc.), emotions, rules of conduct, stereotypes, archetypes, associations, visual images, spontaneous behavior (such as impulse or habitual shopping), intuition , non-verbal communication and more. Another circuit, the human conscious "thinking" mind, facilitates thinking by providing working memory for processing verbal messages, evaluating the costs and benefits of options, and planning ahead (eg, making a shopping list). It is a system that responds to surveys and group discussions when consumers try to explain why they do what they do (Bhatia, 2014, p. 5-6).

4. Neuromarketing

Today, neuromarketing is at the intersection of behavioral psychology, economics and consumer neuroscience, as confirmed by numerous definitions of neuromarketing. Many authors describe neuromarketing as a research tool that provides direct observations of brain responses during marketing stimuli (Hubert and Kenning, 2008, according to Fortunato, Giraldi and Oliveira, 2014, p. 205). According to some researchers, the brain is a black box that hides the consumer's emotions and preferences (Marci, 2008; Javor et al., 2013; Fugate, 2007; Green and Holbert, 2012, according to Fortunato, Giraldi and Oliveira, 2014, p. 205), and neuromarketing acts as a window that reveals and gives access to these feelings (Green and Holbert, 2012; Ohme and Matukin, 2012; Fisher, Chin, and Klitzman, 2010, according to Fortunato, Giraldi, and Oliveira, 2014, p. 205). By gaining insight into individuals' brain processes, researchers will be able to understand, evaluate and predict consumer behavior (Fisher et al., 2010; Hubert & Kenning, 2008; Perrachione & Perrachione, 2008, according to Fortunato, Giraldi & Oliveira, 2014, p. 205). As Morin notes, neuromarketing is to marketing what neuropsychology is to psychology. While neuropsychology studies the relationship between the brain and human cognitive and psychological functions, neuromarketing pro-

motes the value of observing consumer behavior from a brain perspective (Morin, 2011, p. 132). The goal of consumer neuroscience is to adapt methods and theories from neuroscience - combined with behavioral theories, models and tested experimental designs from consumer psychology and related disciplines, such as behavioral decision science, and develop a neuropsychologically sound theory that will understand consumer behavior. To understand the value of combining neuroscience with consumer psychology, it is important to understand the wide range of insights that come from neuroscience.

Neuroscience, therefore, is the study of the nervous system that seeks to understand the biological basis of behavior (Plassmann et al., 2012, p. 18). Consumer neuroscience studies the cognitive and affective sides of human behavior and uses a variety of brain scanning techniques (such as fMRI, PET and EEG), eye tracking and physiological measurements (heart rate, breathing rate and galvanic skin response) to understand the unconscious drivers of choices and preferences . Namely, since consumers are not aware of these unconscious drivers, it is not possible to discover them with traditional techniques such as focus groups, interviews and questionnaires. This leads one to think that neuromarketing methods bring an end to traditional market research methods, however, it is more appropriate to see them as "upgrades" to traditional methods.

Because emotions are powerful mediators of how consumers process messages, understanding and modeling cognitive responses for the purpose of selling messages has always been a methodological challenge. For example, researchers have primarily relied on consumers' ability to report their feelings about a particular ad, either in a confidential setting such as a face-to-face interview, survey, or focus group. Unfortunately, these methods have shown considerable limitations. First, they assume that people are able to describe their own cognitive process, which we now know has many subconscious components (Morin, 2011, p. 132-133). However, as Matukin and Ohme warn, due to people's tendency toward cognitive consistency, declarative data may sometimes fail to reflect ambiguous opinions or more subtle differences in attitudes. Second, a number of factors motivate research participants to misrepresent their feelings. In this challenging context, the emergence of neuromarketing methods offered an exciting methodological alternative. Namely, such methods finally enable marketers to explore the brain of the consumer in order to gain valuable insights into the subconscious processes of the consumer, thereby explaining the reasons for the success or failure of the message. They do this by removing the biggest problem facing conventional advertising research, which is the belief that people have both the will and the ability to report how they are affected by certain advertisements (Morin, 2011, p. 133). Namely, the use of brain imaging techniques can distinguish the subject's cognitive and emotional experiences (verbally expressed during the interview) from the activation of brain areas associated with different and unconscious mental states. The exponential growth of scientific papers using neuroscience-based technologies to assess consumer interest in decision-making for marketing campaigns is almost parallel to the increasing number of available neuromarketing companies (Plassmann et al., 2012).

5. The ethics of neuromarketing in practice

Public reactions to neuromarketing were and still are unfavorable. However, academic thinking about the ethical limits of neuromarketing did not emerge from these public debates. Their source can be traced back to the bioethical tradition, where issues such as the protection of human research subjects, informed consent, privacy and autonomy are common. This explains why ethical issues overlap between the ethics of neuromarketing, bioethics and what is now called "neuroethics". Precisely with the aim of better regularization and acceptance of neuromarketing techniques, many authors proposed the adoption of a code of ethics for the field of neuromarketing.

In this chapter, we will talk about neuroethics and the basis for creating a code of ethics in the field of neuromarketing. The NMSBA code of ethics for the application of neuroscience in business will be analyzed in detail and an overview of its shortcomings will be given. Finally, a proposal will be made for the steps needed to update the Code, in order to achieve a balance between economic interests and ethical requirements.

Ethical problems in brain research have led to a new field of research called neuroethics (Fuchs, 2006, according to Hensel et al., 2017, p. 68). Ethics of practice is actually research ethics applied to neuroscience, where the focus is on how these studies are designed and conducted from a moral perspective; the ethical implications of neuroscience

look at the application of these studies in the real world, just like the applications of neuromarketing that undergo ethical evaluation to limit the impact on business practices (Roskies, 2002, according to Duc, 2017, p. 34).

Due to all the ethical issues that neuromarketing raises, the solution proposed by various authors for better regularization and acceptance of neuromarketing techniques was the adoption of a code of ethics for the field of neuromarketing (Murphy et al., 2008; Hubert and Kenning, 2008; Ezer et al., 2011; Morin, 2011; Butler, 2008, according to Fortunato, Giraldi and Oliveira, 2014, p. 208). In 2008, Murphy et al. thus proposed a code of ethics that would promote research and development, entrepreneurship, and for-profit entrepreneurship, along with the benevolent and non-harmful use of neuroimaging technology at all stages of development, deployment, and dissemination (Murphy et al. 2008, according to Clark, 2017, p.153).

Murphy and colleagues thus concluded their work on the topic of neuroethics in neuromarketing with a preliminary version of the code of ethics, as a recommendation to the neuromarketing industry. In doing so, they divided the ethical issues into two main categories: (1) the protection of the various parties that may be harmed or exploited by research, marketing, and the introduction of neuromarketing (consumer neuroscience); (2) protecting consumer autonomy if neuromarketing reaches a critical level of effectiveness (Hensel et al., 2017, p. 69). The preliminary code is divided into five points: protection of research subjects; protection of vulnerable niche population; full disclosure of objectives, risks and benefits; precise representation of media and marketing and internal and external validity - at the same time, the main ethical issues related to neuromarketing. Apart from the mentioned shortcomings of the Code, one of the main challenges is the great dynamics in the neuromarketing industry, which makes it difficult to create comprehensive up-to-date guidelines. In addition, the combination of different neuromarketing tools makes it difficult to assess what is ethically correct. Given the dynamism of the field and the ever-accelerating technological progress, new tools will be developed in the future, and existing valuation algorithms will be constantly improved.

This requires continuous review and adaptation of existing ethical codes. Another source of ethical problems is the inseparability of academic consumer neuroscience and applied neuromarketing. Academics and industry should work more closely together to learn from each other and share important knowledge, which should be reflected in a comprehensive code of ethics that covers both worlds. Namely, the development of guidelines with the standards of academics and the specific characteristics of different tools would help to overcome many ethical challenges and would reduce the chance of conducting ethically deficient studies, thus giving greater confidence to the field of neuromarketing (Murphy et al. 2008, according to Hensel et al., 2017, p. 80-84).

(Fortunato and Giraldi, 2014, p.17) indicate that the main ethical problem is not respecting consumer privacy and autonomy. Second, most research is conducted without medical supervision and is mostly conducted for commercial purposes, as well as the abuse of conducting research on vulnerable groups, such as children. Hensel et al believe that the potential of neuromarketing can only be harnessed if trust in the industry is increased, and this strongly correlates with ethical behavior in the use of neuromarketing tools. Hensel et al. believe that both academic researchers and practitioners must consider ethical issues not only in general, but also based on the characteristics of different tools (Murphy et al. 2008, according to Hensel et al., 2017, p. 84).

Trettel and colleagues also agree that it is valid:

- increase the transparency and reliability of neuroscience-based methodologies offered by neuromarketing companies;
- increase the transparency and reliability of communication about neuromarketing methodologies.

Finally, it should be emphasized that the relationship between the code, ethical practice and legal regulations is complex and that ethical evaluation is not only a matter of applying the code and law. Namely, it is primarily about the fact that codes and laws are general and often do not provide clear guidelines in certain complex cases. In that case, the legality of something depends on the judgment of the ethics committee. Furthermore, codes and legal regulations omit many research procedures because they aim to exclude some obviously unethical practices, without giving clear ethical advice. Likewise, the content of certain guidelines may be controversial or contradictory. It is also import-

ant to note that although laws or codes are clear, this does not necessarily make them ethically correct (Hughes et al., 2010, p. 11). Also, it should be kept in mind that research profitability should not be the only motivation for conducting neuromarketing research.

6. Research methodology and results

Although one of the goals of the NMSBA Code is to restore public confidence in the legitimacy and integrity of neuromarketers, public confidence in the field of neuromarketing and marketing in general remains low. This is also confirmed by a study conducted in 2014 in the USA, the aim of which was to assess the level of reputation of several professional categories derived from professional research (Trettel et al., 2017, p. 108). It is the duty of scientists conducting scientific research in the field of neuromarketing or related fields to clearly explain the current limitations and strengths of neuromarketing techniques in their communications. At the same time, these communication actions must be carried out according to different goals: the same scientific community, shareholders of such techniques, as well as stakeholders and the general public. The goal of such communication is to increase research awareness of the capabilities and limitations of currently available methodologies when applied to marketing relevant stimuli in order to better understand their effects and consumer behavior. In accordance with the above, the basic goals of the work were defined:

- determine the level of knowledge of the respondents about neuromarketing;
- determine the respondents' perception of the possibilities of applying neuromarketing and their implications;
- determine the respondents' perception of the ethical application of neuromarketing for marketing and sales purposes;
- determine the connection between the respondents' level of knowledge about neuromarketing and their perception of the implications of its possibilities and its ethics.

Hypothesis H1: The majority of respondents do not possess a sufficient level of knowledge about neuromarketing necessary for a correct understanding of the implications of its application.

Hypothesis H2: Most respondents base their knowledge of neuromarketing on scientifically unfounded sources.

Hypothesis H3: Respondents perceive neuromarketing as a means of manipulation and taking away consumers' privacy and autonomy.

Hypothesis H4: The majority of respondents perceive neuromarketing as a means of aggressive practice and deceiving consumers.

Hypothesis H5: Most respondents perceive neuromarketing as unethical because it bypasses the consumer's awareness to influence their decisions.

Hypothesis H6: The majority of respondents believe that the benefits of neuromarketing for consumers are smaller compared to its potentially negative effects.

In order to achieve the objectives of the research and test the hypotheses, a survey questionnaire was designed. Although the terms used are consistent with data from the available literature, the questionnaire was not taken from previously published research. Given that such research has not been conducted in the Republic of Croatia before, primary results were used. The questionnaire consisted of three parts. The first part contained six sociodemographic questions, while the second part contained three questions related to the respondents' level of knowledge about neuromarketing. The third part of the questionnaire contained twenty-four questions divided into three groups of questions. Respondents had to give their assessments on a five-point Likert-type scale, where the lowest intensity of agreement is associated with the rating "one" - "completely disagree", and the rating "five" is the highest intensity of agreement - "completely agree". The Likert scale was used to measure three dimensions of the assessment of the perception of the possibilities and ethics of neuromarketing in the application of respondents, citizens of the Republic of Croatia: 1) perception of the possibilities of neuromarketing methods; 2) perception about the implications of the application of neuromarketing methods and 3) perception about the benefits / dangers and (un)ethicality of neuromarketing. 420 questionnaires were collected, of which 74 questionnaires were invalid, due to the fact that the respondents gave double answers on Likert-type scales.

The sample for data analysis therefore consists of 346 correctly completed questionnaires. The collected data were processed using the statistical package SPSS 21. The data were analyzed using the t-test and p-test methods. Hypothesis testing refers to the procedure by which the researcher

checks the probability of the proposed hypothesis using statistical methods (Petz et al., 2005). When speaking in terms of inferential statistics, the most common test is the hypothesis of no difference or association between the phenomena being measured. Before examining the defined hypotheses, at the beginning of the work itself, the reliability and validity of the applied measurement scales were checked. The reliability of the measurement scales was tested by calculating the *Cronbach Alpha* coefficient and by calculating what the value of the Cronbach Alpha coefficient would be on individual measurement scales, in the event that an individual claim were excluded from the corresponding measurement scale.

The first part of the research refers to the determination of the socio-demographic structure of the respondents, which is presented in detail in table number 1 [Table 1].

Table 1.
Table of socio-demographic structure

Question	Number of respondents	Percentage
Sex		
Female Male	231	66,76 %
	115	33,23 %
Age		
18 – 25	74	21,38 %
26 – 35	53	15,31 %
36 – 45	82	23,69 %
46 – 55	84	24,27 %
56 – 65	42	12,13 %
66 +	11	3,17 %
Education degree		
Unfinished elementary school	-	-
Completed elementary school (NSS)	1	0,28 %
Completed secondary school (SSS)	116	33,52 %
Completed undergraduate studies (baccalaureate) (VSS)	82	23,69 %
Completed graduate studies or studies according to the old system (VSS - dipl., m.sc.)	114	32,94 %
Completed postgraduate studies, scientific master's degree or doctoral studies (VSS - master's degree, doctor's degree, univ. spec., professional spec.)	33	9,53 %
Place of residence (name of the county)		
City of Zagreb	104	30,05 %
Varazdin county	40	11,56 %
Zagreb county	29	8,38 %
Međimurska county	27	7,8 %
Splitsko-dalmatinska county	25	7,22 %
Istarska county	23	6,64 %
Primorsko-goranska county	18	5,2 %
Koprivničko-križevačka county	17	4,91 %
Dubrovačko-neretvanska county	15	4,33 %
Osječko-baranjska county	8	2,31 %
Bjelovarsko-bilogorska county	6	1,73 %
Vukovarsko-srijemska county	6	1,73 %
Karlovačka county	5	1,44 %
Krapinsko-zagorska county	5	1,44 %
Ličko-senjska county	5	1,44 %
Šibensko-kninska county	5	1,44 %
Zadarska county	4	1,15 %
Sisačko-moslavačka county	3	0,86 %
Brodsko-posavska county	1	0,28 %
Current work status		
Employed	251	72,54 %
Retired	12	3,46 %
Unemployed	10	2,89 %
Student	73	21,08 %

The sample includes 346 respondents, of which the majority of respondents are women - 231 of them, or 66.76 percent. With regard to the age structure, respondents in the age group of 46 to 55 years old (24.27 percent) and 36 to 45 years old (23.69 percent) predominate. The age group from 18 to 25 is almost equally represented, represented by 21.38 percent. As far as the level of education is concerned, most of the respondents - 33.52 percent of them have completed secondary school (SSS), but almost equally also university-educated respondents, i.e. those who have completed graduate studies or studies under the old system (VSS - dipl., m.a. sc.) – 32.94 percent of them. The sample includes all counties in the Republic of Croatia, except Virovitica-Podravina and Požega-Slavonia (although the questionnaire was sent to all counties, no responses were received from those two counties). The most represented counties, or places of residence of respondents, are the City of Zagreb (30.05 percent); followed by Varaždin County

(11.56 percent), Zagreb County (8.38 percent), then Međimurje County (7.8 percent), Split-Dalmatia County (7.22 percent) and Istria County (6.64 percent). Other counties are represented in a ratio of less than 6 percent.

Most of the respondents are employed - 72.54 percent, while only 2.89 percent are unemployed and 3.46 percent are retired. Students make up 21.08 percent of respondents. After the socio-demographic profile of the respondents was defined, the aim was to determine the level of knowledge of the respondents about the concept of neuromarketing. More than half of the respondents - 65.02 percent of them - come into contact with the term neuromarketing for the first time, while 31.5 percent of them state that they have basic knowledge about neuromarketing, that is, they are familiar with its definition and purpose. Only 3.46 percent of respondents have advanced knowledge about neuromarketing, i.e. they are familiar with the techniques and methods used, research protocols, methods of application and implications of application.

Table 2.
Cronbach Alfa – reliability of statistical data

Reliability Statistics (reliability of statistical data)		
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**
.801	.792	24

The table shows that the Cronbach Alpha coefficient is 0.801, which indicates that the used measurement scales have a high level of reliability. In order to test the hypotheses, a t-test was used. The t-test is a statistical procedure for testing the significance of the difference between two samples, in which their arithmetic means are compared. The t-test actually serves to check the hypothesis that is set when forming the research draft. Furthermore, the same examines whether there is a statistically significant difference between the possibilities offered by neuromarketing and neuromarketing methods and to establish the difference in small and/or large possibilities brought by neuromarketing research.

Table 3.
Respondents' perception of the possibilities of neuromarketing as a science

	Arithmetic mean (standard deviation)		Difference	95 % span reliability		t (df)	
	Little ones possibilities	Big possibilities		From	To		
Some of the neuromarketing methods used can be unpleasant and dangerous for the subject.	3,16 (1,1)	3,82 (1,1)	-0,658	-1,0	-0,4	-4,2 (251)	<0,001
With the help of neuromarketing methods, companies can read the minds of consumers.	3,4 (1,0)	4,27 (0,9)	-0,632	-0,9	-0,4	-4,8 (251)	<0,001
With the help of neuromarketing methods, companies gain great power to influence the purchase decision.	3,9 (1,0)	4,34 (0,9)	-0,553	-0,8	-0,3	-4,3 (251)	<0,001
With the help of neuromarketing methods, companies can discover a neurological "buy" button in the consumer's brain, which they can manipulate without the consumer's consent in order to achieve the desired profit.	2,69 (1,0)	3,21 (0,9)	-0,523	-0,8	-0,3	-3,9 (251)	<0,001
With the help of neuromarketing methods, companies can create advertisements whose influence consumers cannot resist.	3,49 (1,1)	4,13 (1,0)	-0,642	-0,9	-0,4	-4,6 (251)	<0,001
With the help of neuromarketing methods, companies manipulate the decision-making process of consumers and try to wrongly convince them that they want or need a product.	3,24 (1,1)	4,04 (1,0)	-0,640	-0,9	-0,4	-4,5 (251)	<0,001
Neuromarketing does not have the possibility to generalize its findings because people do not have identical thoughts, personal experiences, values, or character.	3,12 (1,1)	3,92 (0,9)	-0,706	-1,0	-0,4	-5 (251)	<0,001

**Student's t-test*

In Table no. 3. Student's t-test was used to test the existence of a difference in the evaluation of respondents' perceptions and the use of neuromarketing methods, whether they can read customers' thoughts, whether they are more or less unpleasant, whether they have the possibility of influencing purchasing decisions. The significance level was set at $\alpha = 0.05$. The probability (p) is lower than the level of significance, according to all claims, and it can be concluded that there is a significant difference in the assessment of the concept of neuromarketing methods as a science compared to the knowledge and acceptance of neuromarketing methods. Furthermore, 65.02 percent of respondents come into contact with neuromarketing for the first time, and only 31.5 percent of respondents know the definition and purpose of using neuromarketing methods of science. Hypothesis H1: The majority of citizens of the Republic of Croatia do not possess a sufficient level of knowledge about neuromarketing necessary for a correct understanding of the implications of its application is considered accepted.

Table 4.
Results of the t-test for the sample that verifies neuromarketing as a means of manipulation that takes away privacy and autonomy and as a means of aggressive practices and consumer deception (N = 346).

Claims	M	SD	t	p
Observing someone's brain activity through neuromarketing methods is a violation of his/her privacy.	3,43	1.15	-0.239	0.812
Neuromarketing poses a great threat to the consumer's autonomy because it removes his defense mechanisms.	3,23	1.16	-2.994	0.003

Note: t – t-test result (df = 213), p – statistical significance; the difference from the value "3" was observed.

Neuromarketing methods represent an aggressive commercial practice because they impose a product on a consumer for whom he might not show interest, and the purchase of the product is significantly related to the continuation of the purchase ($p > 0.05$). On the other hand, ne

uromarketing is not transparent and has a misleading character because it misrepresents the true commercial purpose of neuromarketing communications ($r = 0.144$, $p = 0.035$). Neuromarketing methods can lead to excessive consumption and commercialization because they affect the consumer's subconscious, which especially affects vulnerable consumer groups ($r = 0.229$, $p < 0.001$) and the ultimate goal of neuromarketing methods is the acquisition of commercial profit, without taking into account the consumer's interest ($r = 0.280$, $p < 0.001$). With neuromarketing, the consumer, under the influence of external and hidden influence, loses the ability to independently make a purchase decision ($r = 0.267$, $p < 0.001$). Likewise, neuromarketing poses a great threat to consumer autonomy because it removes his defense mechanisms ($r = 0.135$, $p = 0.048$). According to the results, the respondents believe that neuromarketing is an aggressive method that takes away privacy and autonomy. Such results support hypotheses 3 and 4.

Furthermore, an effort was made to check whether the importance of individual respondents' opinions about neuromarketing as a scientific discipline is changing, and the respondents were asked to respond to statements such as "observing someone's brain activity through neuromarketing methods represents a violation of his/her privacy", "due to the use of neuromarketing methods, the consumer loses the right to retain and control information about oneself", "neuromarketing methods accelerate the development of automatic profiling, thereby reducing consumer autonomy", "neuromarketing represents a major threat to consumer autonomy because it removes its defense mechanisms", "with neuromarketing, the consumer is under the influence of external and hidden influence , loses the ability to independently make a purchase decision". An attempt was made to determine what role the level of knowledge about neuromarketing plays in explaining neuromarketing as a science as a whole.

As already mentioned, there is a weak connection between the knowledge and understanding of neuromarketing activities and their role, given that a large percentage of respondents who encounter the term neuromarketing for the first time or who learned about neuromarketing from various publications that have no foundation were found in science. So, we can conclude that the connection is not linear and it is shown in table no. 5 [Table 5]. From the correlation, it can be concluded that knowledge and understanding of neuromarketing as a science are related, that is, the smaller the amount of knowledge about neuromarketing, the less understanding and appreciation of neuromarketing as a science. In doing so, we compare the p

level with the significance level of 0.05. If it is established that p is greater than 0.05, it is said that the correlation coefficient is significant and may be interpreted. If the value of p is less than 0.05, it is concluded that the correlation coefficient is not significant and then, regardless of its value, it should not be interpreted. The value of the Pearson correlation coefficient ranges from +1 (perfect positive correlation) to -1 (perfect negative correlation). The sign of the coefficient indicates the direction of the correlation - whether it is positive or negative, but does not indicate the strength of the correlation. Pearson's correlation coefficient is based on the comparison of the actual influence of the observed variables on each other in relation to the maximum possible influence of the two variables, whereby (Bilodeau & Brenner,2013):

- r = 0 to ± 0.25: no association;

- r = ± 0.26 to ± 0.50: weak association;

- r = ± 0.51 to ± 0.75: moderate to good correlation;

- r = ± 0.76 to ± 1: very good to excellent correlation;

- r = ± 1: mathematical connection.

Table 5.
Pearson's correlation coefficient

		Loss of the ability to independently make a purchase decision	Acquisition of commercial profit	Shopping and consumption thanks to neuromarketing research
Loss of the ability to independently make a purchase decision	Pearson Correlation	1	.631**	.133**
	Sig. (1-tailed)		.000	.000
	N	231	2314	231
Acquisition of commercial profit	Pearson Correlation	.631**	1	.126**
	Sig. (1-tailed)	.000		.000
	N	231	231	231
Shopping and consumption thanks to neuromarketing research	Pearson Correlation	.367**	.394**	1
	Sig. (1-tailed)	.000	.000	
	N	231	231	231

**. Correlation is significant at the 0.01 level (1-tailed).

When calculating the correlation, the respondents gave the following answers: Neuromarketing as a scientific discipline affects the consumer's subconscious, that is, it is able to predict the consumer's behavior and his choice of products. This is precisely what is considered one of the ethical issues faced by neuromarketing, i.e. neuromarketing research (Pearson's correlation coefficient, r= 0.505), which reduces consumer autonomy.

Also, the possibility of predicting future events, i.e. consumer behavior, diminishes the value of man as a being who has the ability to think. The meaning of man's value, his dignity and freedom is called into question. Given that a large percentage of the respondents stated that they are encountering the term marketing for the first time, there is an extremely large and strong correlation between the loss of independent decision-making about product selection and the fact that, according to the respondents, it is carried out for the purpose of gaining commercial profit (r= 0.631).

Furthermore, when buying a certain product, the consumer comes across products that the manufacturer, thanks to neuromarketing research, has predetermined as products that the consumer will buy (r= 0.367). Considering the presented results of the Pearson coefficient, it can be concluded that there is a positive relationship between the amount of knowledge and opinion about neuromarketing activities.

Despite the knowledge that consumer behavior is a product of images, events, experience, attitudes and motives, consumer behavior thanks to neuromarketing becomes the subject of the limbic concept, which means that consumer behavior depends not only on the mode of seeing the consumer himself, but also on the models of connection between affective, cognitive and connotative attitudes, i.e. consumer impressions towards products that the consumer intends to buy. When choosing a product, the consumer's attitude plays an extremely important role, which can be defined as collective evaluations of different products, and they are important as a determinant and indicator of shopping behavior, but the construct of attitude itself is not a permanent category (Sznajd-Weron, 2000, p. 1157-1165).

In other words, the beliefs about the products that the consumer selects and then buys are characteristics that consumers attribute to them, and as such, they can relate to emotional responses, and much less often, to cognitive ones. At the same time, we should not forget how consumers change their attitude due to social interaction (Solomon, 2003) and can transform it after perceiving the product and its values. Too much choice

of products leads to micro-systematic consumer frustration (Sznajd-Weron, 2005, p. 2537-2547), which through the process of social valence can qualitatively use the positive image of the product that the consumer has. In this way, a certain faction is created that must prevail in favor of one competitive product, which again leads us to a clear answer that the consumer is aware of his choice and purchase. Rational and random consumers have decreasing demand curves is based on the assumption that rational choice can be identified with the result of random behavior, i.e. random selection. An irrational consumer does not always choose the consumption combination that is in the middle of the budget line by random selection. When asked about the role and significance of neuromarketing research, whether it can be seen as manipulation or a need, the respondents showed a certain doubt to what extent neuromarketing could contribute to identifying their desires and thereby managing consumer satisfaction. Heuristics are effective cognitive processes that ignore information. Homo-heuristicus has a biased mind and ignores some of the available information, but the biased mind can deal with uncertainty more effectively and more powerfully than the unbiased mind by relying on more resourceful and general purpose processing strategies (Gigerenzer and Brighton; 2009, p.107).

Heuristics can lead to more accurate conclusions than strategies that use more information and computation, that is, achieve greater accuracy without effort. Even when information and calculations are completely free, sometimes more information and/or calculations can reduce accuracy, so individuals rely on simple heuristics. Heuristics turn out to be more accurate than strategies that use more information and time. Human action is influenced by information, desires and time available. With the help of information, the consumer forms an opinion, forms certain attitudes and creates desires. Desires make an individual, a consumer. Human action is influenced by information, desires and time available. With the help of information, the consumer forms an opinion, forms certain attitudes and creates desires. Desires make the individual, the consumer, and his behavior unique. They are different for each individual and the consumer shapes his behavior according to them, in order to satisfy them. The time available also affects human behavior, because it is important to the individual. When choosing between actions that have different time periods, the individual often chooses the one with a shorter time period, but with the maximization of positive feelings and the minimization of negative feelings. and his behavior unique. They are different for each individual and the consumer shapes his behavior according to them, in order to satisfy them. The time available also affects human behavior, because it is important to the individual. When choosing between actions that have different time periods, the individual often chooses the one with a shorter time period, but with the maximization of positive feelings and the minimization of negative feelings.

Table 6.
Respondents' views on the use of neuromarketing research

	I don't agree at all	I mostly dis-agree	I can not decide	I agree	I com-pletely agree	In total	Test
Manip-ulation	18	61	52	115	100	346	χ2=15,988
	5,20%	17,63%	15,03%	33,24%	28,90%	100%	df=3
Need	39	47	66	105	89	346	p=0,001
	11,27%	13,58%	19,07%	30,35%	25,72%	100%	

Almost half of the respondents, i.e. 43.92%, do not have a perception of the expediency of applying neuroscience to predicting and understanding consumer needs. From the above, it can be concluded that almost every second respondent does not perceive neuroscience as a tool that can be used in understanding and predicting their needs. It is interesting that 62.14% of respondents see the possibility of manipulation of neuromarketing research. 56.07% of respondents believe that the use of neuroscience is useful for consumers because it can be used to better understand and predict the needs of consumers, that is, the people for whom the product is intended.

6.1. Discussion

Through the research conducted using the method of random selection, several conclusions were reached. The assumption was that the respondents do not have sufficient knowledge about neuromarketing, which can ultimately result in them succumbing to the established myths about neuromarketing and the wrong perception of its possibilities. It has been proven that more than half of the respondents come into contact with neuromarketing for the first time and that a small percentage of them even know the definition and purpose of using neuromarketing methods of science, thus confirming hypothesis H1 according to which the majority of citizens of the Republic of Croatia do not possess a sufficient level of knowledge about neuromarketing

necessary for correct an understanding of the implications of its application is considered accepted. Likewise, the majority of respondents acquire their knowledge about neuromarketing from scientifically unfounded sources, which certainly affects their perception of neuromarketing. The results of the Pearson coefficient confirm that there is a positive relationship between the amount of knowledge and opinions about neuromarketing activities. Namely, from the correlation it can be concluded that the knowledge and understanding of neuromarketing as a science are related, that is, the smaller the amount of knowledge about neuromarketing, the less the understanding and appreciation of neuromarketing as a science.

In accordance with established myths about the real possibilities of neuromarketing, it can be perceived as a "magnifying glass" for observing mental processes without directly communicating with consumers about their thoughts, memories, evaluations or decision-making strategies, thus in fact it can provide access to otherwise hidden parts of the consumer's brain, directly bringing in the question of protection of privacy, dignity and autonomy of consumers. So, when it comes to the ethics of neuromarketing, it can be approached from two basic points of view: a) protection of vulnerable parties from the harm of using different neuromarketing methods and b) protection of consumer autonomy when making purchase decisions. The research proved that the respondents perceive neuromarketing precisely as a means of manipulation and deprivation of consumer privacy and autonomy. The above goes in the direction of the recommendations of many authors who believe that the dignity and integrity of the human being should be protected by respecting the autonomous deliberation of the human individual about his preferences. In addition to the violation of privacy, the use of marketing methods also raises some new questions, such as the right of each person to retain and control information about himself, which is violated in behavioral online advertising. Respondents also see neuromarketing as a means of aggressive practice and deceiving consumers. For most of them, neuromarketing represents a major threat to the consumer's autonomy because it removes his defense mechanisms. Such a perception contributes to respondents' opinion that neuromarketing is unethical because it bypasses the consumer's awareness to influence their decisions. It is interesting that the perception of the harmfulness of neuromarketing has not wavered, even when it comes to the use of neuromarketing research for charitable and scientific purposes. Namely, the respondents, regardless of the ultimate purpose of neuromarketing, perceive it as unethical. Respondents are also undecided about the claims that neuromarketing can help better identify those products, brands and services that consumers really need, as well as that it improves the consumer experience because it applies the acquired knowledge in product development and design, promotion and advertising, and the design of sales points. On the other hand, they express doubt when it comes to the dominance of potentially negative effects in relation to the benefits of neuromarketing for consumers. Respondents are also undecided about the claim that neuromarketing does not have the ability to generalize its findings because people do not have identical thoughts, personal experiences, values, or character.

However, the aforementioned indecision can be attributed to insufficient knowledge of the possibilities of neuromarketing, which is confirmed in hypothesis H1 and is something that the supporters of neuromarketing themselves point out, stating that it carries the possibility of abuse on the one hand, but also moral responsibility on the other. In this sense, the solution proposed by various authors for better regulation and acceptance of neuromarketing techniques is the adoption of a code of ethics for the field of neuromarketing. As many authors state, the potential of neuromarketing can only be used if trust in the industry increases, which strongly correlates with ethically correct behavior when using neuromarketing tools. In this sense, and based on the results of the research, the main recommendation is that neuromarketing companies increase transparency about the real possibilities of neuromarketing methodologies and that they adequately communicate such services to the general public and industry, which will contribute to increased knowledge of public opinion and, consequently, the correctness of its perception of such methodologies. In parallel with the above, it is also important to communicate about neuromarketing methodologies and to increase their transparency and reliability in such a way as to increase the number of scientific sources that would avoid exaggerated promises about the power of neuromarketing methods and provide the public with a clearer and more credible picture of the (im)possibility of neuromarketing.

The first limitation of the study is related to the size and representativeness of the sample. Namely, the research was conducted on 346 re-

spondents and if the number of inhabitants of the Republic of Croatia is taken into account, the sample size used in this research is not satisfactory to be able to draw final conclusions. Furthermore, not all parts of the Republic of Croatia are equally represented in the sample, that is, certain counties are not represented at all. Despite the above, the obtained results are suitable for drawing indicative conclusions, but it should be emphasized that in order to create a complete picture, it would be necessary to conduct research on a larger sample and include all counties of the Republic of Croatia.

Furthermore, the limitation of the research is related to the lack of previous research on the mentioned topic in Croatia, with which the results of the conducted research could be compared. Due to the impossibility of comparing the results, as well as drawing conclusions based on their comparison, the interpretation of the research results is also difficult.

7. Conclusion

In a globalized landscape where there is a constant and relentless battle to win the favor of consumers, getting to know consumers becomes a crucial priority for companies because, contrary to the former belief that consumers behave in a logical way, it is now known for sure that consumers make most of their purchasing decisions on an unconscious level, and therefore inaccessible to marketers. It was this realization that imposed the need for new methods of market research that would provide more reliable and precise data on consumer behavior as a basis for better business decisions. In this challenging context, the emergence of neuromarketing - an emerging field that can be defined as a bridge between neuroscience and marketing - offered an exciting methodological alternative. However, despite its value to businesses, neuromarketing has sparked widespread debate about the ethical nature of it. This was contributed to on the one hand by the entire atmosphere surrounding neuromarketing, which is full of numerous misunderstandings and 'loose' interpretations supported by the media, and on the other hand by the very language used by neuromarketing, as well as the claims made by researchers and practitioners about what this field is all about. can realistically provide. Namely, many authors point out as a limitation that it is a very complex science and that, accordingly, little can be generalized or stated with certainty. Likewise, some of them believe that neuromarketing is closer to science fiction than reality because it is impossible to find people with identical thoughts in the world, given that thought is changeable and varies depending on personal experiences, values and character. Such an atmosphere of mystique surrounding neuromarketing, although very attractive to marketers - especially because it ostensibly gives them the opportunity to offer consumers something that goes beyond traditional market research tools, results in consumers fearing that neuromarketing tools can actually give insight into their thoughts, i.e. a violation their privacy, autonomy and dignity. The aim of this work was therefore to determine, first of all, the level of knowledge of the citizens of the Republic of Croatia about the concept of neuromarketing and, accordingly, their perception of the ethical implications of the application of neuromarketing methods.

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