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Exploring Public Perceptions of Neuromarketing: Ethical Challenges in the Kazakhstani Context

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ABSTRACT

Neuromarketing, situated at the intersection of neuroscience and marketing, presents new opportunities for examining the underlying mechanisms of consumer behavior, while also generating a wide range of ethical concerns. The purpose of the article is to conduct an empirical assessment of public perceptions and ethical risks associated with the use of neuromarketing in Kazakhstan, with an emphasis on issues of privacy, manipulation, informed consent and regulatory enforcement. The work employs a quantitative cross-sectional design, based on an online survey conducted using the principle of a "snowball" sampling approach in social networks and university newsletters. The study involved 211 respondents, primarily young and middle-aged individuals, with a predominance of urban residents and those with higher levels of education. The study revealed a low level of public awareness about neuromarketing (36%), while ethical concerns were expressed very clearly (84.4%), supporting the principle of transparency (76.3%), and 81.5% supported stricter regulation. Commercial applications were supported by only 42.2%, while social practices (healthcare, education) were approved. More than half of the respondents (61.6%) expressed unwillingness to participate in neuromarketing research personally. Gender differences turned out to be statistically insignificant, while age demonstrated a significant effect: older groups were more likely to support increased regulation. The data obtained confirm the high sensitivity of society and indicate the need for the development of national regulatory standards in the field of neuromarketing. Further investigation is advisable to be conducted on more representative samples using mixed methods for a deeper understanding of the dynamics of public perception.

KEYWORDS: Digitalization, Digital Economy, Business, Consumer Behavior, Marketing, Neuromarketing, Neurotechnology

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1. INTRODUCTION

Neuromarketing has recently emerged as a powerful and controversial intersection of neuroscience and marketing, offering previously unavailable insights into the unconscious processes that underlie consumer decision-making. Advanced techniques such as electroencephalography (hereinafter – EEG), eye-tracking, and functional magnetic resonance imaging (hereinafter – fMRI) allow researchers to study real-time cognitive and emotional responses to marketing stimuli. This new knowledge promises to revolutionize the effectiveness of advertising, product design, and customer engagement. However, these developments also give rise to a complex set of ethical challenges that have sparked extensive debate among academics, practitioners, and policymakers.

Among the key ethical concerns are the protection of privacy, the adequacy of informed consent, the risk of subconscious manipulation, and the potential for exploiting vulnerable groups. International bodies have begun to formulate ethical recommendations and codes of conduct for neuromarketing and neurotechnologies (e.g., the UNESCO Recommendation on the Ethics of Artificial Intelligence, the Neuromarketing Science and Business Association's Code of Ethics), but national regulation remains limited and inconsistent across countries.

Kazakhstan is a particularly salient case for examining the ethical dimensions of neuromarketing. The country has experienced rapid digitalization and rising interest in neuroscientific tools, as demonstrated by the recent establishment of neuromarketing laboratories at leading universities. Nevertheless, there remains a marked absence of national ethical guidelines, legal frameworks, or meaningful public discourse on the appropriate use of neuromarketing technologies. This regulatory vacuum increases the risk of ethical lapses and may erode public trust as neuromarketing becomes more widely adopted in both commercial and social spheres.

Despite the growing significance of neuromarketing in Kazakhstan, there is a critical shortage of empirical research on how citizens perceive the ethical issues associated with this field. Understanding public attitudes is especially important in emerging markets, where digital literacy and regulatory oversight may be limited, and where cultural values shape ethical expectations in unique ways. The lack of systematic data on public perceptions in Kazakhstan creates a significant barrier to the development of evidence-based regulation, responsible business practices, and effective public education.

This study addresses these challenges by providing the first systematic and empirical assessment of public perceptions and ethical concerns related to neuromarketing in Kazakhstan. The purpose of the article is to conduct an empirical assessment of public perceptions and ethical risks associated with the use of neuromarketing in Kazakhstan, with an emphasis on issues of privacy, manipulation, informed consent and regulatory enforcement. By situating the research within the Kazakhstani context and employing a rigorous, data-driven approach, the study aims to address an important gap in both national and international scholarship.

In doing so, the research not only contributes to academic understanding but also provides practical insights for policymakers, business leaders, and civil society actors regarding the ethical expectations of the Kazakhstani public. The findings aim to provide a foundation for developing culturally relevant ethical guidelines, regulatory frameworks, and public awareness initiatives that ensure the responsible and socially beneficial application of neuromarketing technologies in Kazakhstan.

2. LITERATURE REVIEW

Neuromarketing has evolved into a dynamic interdisciplinary field that integrates neuroscience, psychology, and marketing

science, offering deeper insights into the unconscious mechanisms of consumer behavior (Smidts, 2002; Murphy et al., 2008; Aria & Cuccurullo, 2017; Costa-Feito et al., 2023). In contrast to traditional survey-based approaches, often constrained by cognitive biases and social desirability, modern neuroscientific tools such as EEG, fMRI, eye-tracking, and galvanic skin response (hereinafter – GSR), has significantly enhanced the validity and precision of marketing research (Dos Santos & Dos Santos, 2024; Georgiadis et al., 2023; Pagan et al., 2024).

Among these tools, EEG stands out for its ability to record brain activity with high temporal resolution, providing immediate and fine-grained data on consumers' cognitive and affective reactions to marketing stimuli (Khondakar et al., 2024). Its non-invasive, affordable, and portable nature has made EEG the most widely adopted tool in both academic neuromarketing research and applied commercial settings (Georgiadis et al., 2023). By contrast, fMRI, although considerably more expensive and less accessible, offers superior spatial resolution and the ability to map deeper brain structures, making it invaluable for exploring neural mechanisms of decision-making, reward processing, and emotional arousal. Other instruments, including eye-tracking and facial coding, have further expanded the methodological arsenal of neuromarketing by enabling the measurement of visual attention patterns and subtle affective responses, which are often inaccessible through self-report methods (Šola et al., 2024). Recent methodological advances increasingly emphasize the integration of multimodal datasets, where neurophysiological measures are combined with subjective indicators, thereby allowing for a more holistic and ecologically valid analysis of consumer decision-making (Georgiadis et al., 2023).

However, the rapid proliferation of these technologies has sparked critical debates about their reliability, validity, and the lack of standardized research protocols (Pagan et al., 2024). Scholars highlight the necessity of methodological rigor, adherence to open science practices, and greater transparency in reporting, since inconsistent applications of neuroscientific tools can foster over-interpretation and contribute to so-called "neurohype" in both academia and industry (Christensen et al., 2022). Obtaining valid and informed consent in neuromarketing studies remains a challenge, especially as research extends into digital environments and passive data collection methods are employed. In many cases, consumers are unaware that their neurodata is being collected or how it will be used, leading to concerns over the adequacy of disclosure and the voluntariness of participation (Hemalatha, 2023; Goncalves et al., 2024). Neurophysiological data is highly sensitive and uniquely identifiable, requiring robust data protection, anonymization, and security measures (Ferrell et al., 2025). The misuse of neurodata could lead not only to privacy breaches but also to discrimination or psychological harm if sensitive information is shared or used without consent (Costa-Feito et al., 2023; Christensen et al., 2022). Moreover, neuromarketing can exploit cognitive vulnerabilities by reinforcing stereotypes, promoting overconsumption, or exacerbating inequalities (Fauzi et al., 2022).

These risks are particularly acute in contexts where regulatory oversight is weak and ethical standards are poorly enforced. The regulatory landscape for neuromarketing is fragmented both internationally and nationally. In the European Union, the General Data Protection Regulation (hereinafter – GDPR) classifies neurodata as sensitive personal data, imposing strict requirements for consent, processing, and data transfer (Goncalves et al., 2024). International frameworks such as UNESCO's Recommendation on the Ethics of Artificial Intelligence (2021) emphasize principles of human dignity, fairness, transparency, and accountability in the application of neurotechnologies. In the United States and Western Europe, ethical review boards and institutional research ethics committees provide an additional layer of oversight for academic neuromarketing studies (Murphy et al., 2008). By contrast, in many

emerging markets, there is little formal regulation, few local guidelines, and low public awareness of neuroethical issues (Fauzi et al., 2022).

Cross-cultural research demonstrates that attitudes toward neuromarketing, privacy, and consent are shaped by local values, social trust, and legal traditions (Tomková & Zbihlejová, 2023; Whitsel & Merrill, 2021). In collectivistic societies, the balance between individual rights and group interests influences both ethical expectations and the design of regulatory frameworks (Whitsel & Merrill, 2021). In Asia and Latin America, the adoption of neuromarketing has been slowed by high technology costs, lack of professional capacity, and varying degrees of regulatory development (Fauzi et al., 2022). Studies from Indonesia and Central Asia highlight cultural differences in risk perception, trust in technology, and the prioritization of social good over individual autonomy (Fauzi et al., 2022; Whitsel & Merrill, 2021). However, little is known about how these ethical concerns manifest in Central Asia, and Kazakhstan in particular, where neuromarketing is only beginning to develop.

Empirical research across multiple regions indicates that while social applications of neuromarketing (e.g., health promotion, education) are viewed more favorably, commercial use remains controversial, with strong ethical concerns related to privacy and manipulation (Ulman et al., 2015). Public reluctance to participate in neuromarketing studies is common, reflecting global skepticism regarding neurodata handling and the transparency of research practices (Luna-Nevarez, 2021).

In Kazakhstan, neuromarketing is still in a formative stage. The establishment of neuromarketing laboratories at leading universities and growing corporate interest indicate early diffusion of neuroscientific methods into both business and social sectors (AlmaU, 2024). However, empirical studies are rare, and ethical debate is only beginning to emerge in academic and policy circles. However, empirical studies remain scarce, and ethical debate is only emerging in academic and policy circles. The Law on Personal Data provides some general protection for personal information, but does not specifically address neurodata, consent standards, or data storage protocols (Dentons, 2023; Shyngyssov & Kadyrov, 2023). This legal ambiguity, combined with low public awareness, creates substantial risk for ethical lapses and undermines public trust (Whitsel & Merrill, 2021).

A small number of studies and national reports indicate that Kazakhstani citizens have low awareness of neuromarketing, with a majority expressing concern about privacy, manipulation, and the lack of regulation. Social applications tend to receive higher approval, but many respondents are unwilling to participate in research involving neurophysiological measurements or the sharing of personal data. Despite rapid global advances, the ethical, regulatory, and socio-cultural aspects of neuromarketing in Kazakhstan remain largely unexplored, with most studies focused on methodological innovation in developed countries. Most literature focuses on methodological innovation and the experience of developed countries, with little attention paid to public perceptions, cultural context, or the challenges of policy-making in transitional economies.

Thus, this study represents the first systematic attempt to map public perceptions and ethical concerns regarding neuromarketing in Kazakhstan. By integrating international theoretical developments, methodological best practices, and original empirical evidence, the research aims to inform evidence-based policy design and the development of locally adapted ethical standards. While neuromarketing is increasingly adopted by global corporations in marketing, product development, and user experience, emerging economies such as Kazakhstan must prepare adequate ethical and regulatory frameworks in advance of mass adoption.

While neuromarketing opens new frontiers for understanding consumer behavior, it also brings complex ethical, legal, and cultural challenges, particularly in emerging markets

such as Kazakhstan, where public awareness and regulation have yet to catch up with rapid technological innovation. By critically reviewing global, regional, and national literature, this study fills a significant research gap and provides a basis for developing both policy and practice in the field.

While the present study addresses the ethical and perceptual aspects of neuromarketing in Kazakhstan, it is essential to note that neuromarketing is no longer a niche area in business innovation. On the contrary, many global corporations have already integrated neuroscientific methods into their marketing strategies, product development, and user experience design. This underscores the need for developing countries to prepare ethical and regulatory frameworks in advance of mass adoption.

As shown in Table 1, neuromarketing has been integrated into various industries, including technology, finance, FMCG, and automotive.

Table 1. Global companies applying neuromarketing techniques

Company	Industry	Application Area	Reported Impact
Google	Tech/Internet	Ad optimization, UX	Higher click-through rates, user engagement
Coca-Cola	Beverages	Branding, advertising	Improved recall, brand affinity
Hyundai	Automotive	Product design, user testing	Enhanced customer experience
Campbell's Soup	Food	Packaging design	Packaging redesign, increased sales
Frito-Lay	Food	TV commercials	Message adaptation, improved recall
Unilever	FMCG	New product launches	More efficient marketing campaigns
Procter & Gamble	FMCG	Product testing	Reduced product launch failure rates
PayPal	Finance	Website and checkout optimization	Smoother UX, higher conversion rates

Note: compiled based on Luna-Nevarez (2021), Costa-Feito et al. (2023)

This real-world adoption of neuromarketing by market leaders in multiple industries provides a powerful rationale for proactive policy and ethical debate in contexts like Kazakhstan, where the field is only beginning to emerge. These international cases show that the use of brain-based consumer analytics is not a theoretical possibility but a strategic business reality, raising the stakes for ethical preparedness in developing economies.

In sum, the literature highlights that while neuromarketing offers innovative tools to access unconscious consumer behavior, its ethical implications remain contested across global contexts. Previous studies have primarily focused on Western or highly developed markets, with limited attention to how ethical concerns manifest in emerging economies. This gap underscores the need for localized empirical research, such as the present study, to explore public awareness and ethical expectations in Kazakhstan's specific sociocultural and regulatory landscape.

3. MATERIALS AND METHODS

Neuromarketing research draws on a diverse range of methods derived from neuroscience and psychophysiology, allowing for the examination of consumers' unconscious responses to marketing stimuli. Each of these tools has unique features and limitations. This research employed a quantitative cross-sectional survey to assess public awareness, attitudes, and ethical concerns regarding neuromarketing practices in Kazakhstan. At the same time, no method is universally applicable, and researchers are increasingly employing multimodal approaches (Georgiadis et al., 2023; Pagan et al., 2024). The systematization of their characteristics is presented in Table 2.

Table 2. Neuromarketing methods

Method	Strengths (sources)	Limitations (sources)	Typical applications
EEG	High temporal resolution; portable and affordable (Khondakar et al., 2024; Georgiadis et al., 2023)	Low spatial resolution; limited detection of deep brain structures (Georgiadis et al., 2023)	Advertising response, emotional engagement, attention
fMRI	High spatial resolution; ability to map deep brain activity (Pagan et al., 2024)	Low temporal resolution; expensive; low ecological validity (Dos Santos & Dos Santos, 2024)	Decision-making, reward processing, emotional arousal
Eye-tracking	Direct measure of visual attention (Šola et al., 2024)	Does not capture underlying cognitive processes; requires complementary methods (Georgiadis et al., 2023)	Packaging design, website usability, and UX testing
GSR / Facial coding	Captures physiological arousal and affective reactions (Costa-Feito et al., 2023)	Limited specificity: cannot differentiate positive vs. negative emotions (Christensen et al., 2022)	Emotional arousal measurement, ad testing

Note: compiled by the authors

Despite the wide range of possibilities offered by these methods, their application in neuromarketing is associated with several methodological and practical limitations. Problems of reliability, standardization of protocols, and reproducibility of research entail risks of incorrect interpretation of data, manipulative use of technology, and violation of the principles of voluntary informed consent.

In addition, it is important to note that the listed neuromarketing methods were not used directly in this study. They are presented solely for the purposes of classification and contextualization, whereas the empirical part of the work is based on a questionnaire survey aimed at studying public perceptions and ethical aspects of the use of neuromarketing in Kazakhstan. Furthermore, the methodological basis of the study aimed to test the formulated hypotheses and gather empirical data on the population's perception of neuromarketing practices and related ethical issues in Kazakhstan.

The hypotheses of the study included the following provisions:

H1: Public awareness of neuromarketing is generally low.

H2: Ethical concerns (privacy, manipulation, consent) are widespread.

H3: Public acceptance is higher for socially beneficial uses than for commercial ones.

H4: Age, but not gender is associated with more critical ethical perceptions.

The study could include respondents aged 18 and over who are permanent residents of Kazakhstan, speak Russian or Kazakh, and have given informed consent to participate. The “snowball” method was used to attract participants, which is typical for exploratory research. The Instagram and Facebook profiles were disseminated through social media platforms (Telegram, Facebook, Instagram), university newsletters, and professional communities. A total of 211 valid responses were collected (March-April 2025). Among them, 70.6% were women and 29.4% were men. The average age of the respondents was 32.8 years (SD = 9.4). 78.2% of the participants lived in cities, and 81.1% had higher or postgraduate education. This approach ensured rapid data collection but led to a slight overestimation of the proportion of digitally literate, urban and younger respondents, which limits the possibility of extrapolating the results to the entire population.

The methodological foundation of this study is based on a comparative analysis of neuroscientific and physiological tools

commonly used in neuromarketing research. Rather than treating each method as an isolated technique, the present approach acknowledges that these instruments are most effective when applied in combination, offering complementary insights into consumer cognition, attention, and emotion. For example, while EEG offers high temporal resolution of brain activity, it is often paired with fMRI to overcome spatial limitations and facilitate a more detailed mapping of decision-making processes. Similarly, eye-tracking is frequently used together with galvanic skin response (GSR) to link patterns of visual attention with indicators of emotional arousal, while facial expression analysis (FEA) and implicit association tests (IAT) add behavioral and attitudinal dimensions to the picture.

The questionnaire used in this study was developed based on these international classifications and comparative reviews (Costa-Feito et al., 2023; Georgiadis et al., 2023; Dos Santos & dos Santos, 2024; Šola et al., 2024). It was structured into five sections covering demographics, awareness of neuromarketing, ethical attitudes, application preferences, and willingness to participate. The instrument was pre-tested with 12 respondents and refined according to their feedback. Two academic experts further validated the final version for content clarity and ethical compliance.

The survey design complied with the Declaration of Helsinki and emphasized voluntary participation, informed consent, anonymity, and minimal risk. Data were collected via Google Forms using a snowball sampling approach. No biological or personally identifiable data were recorded, and duplicate responses were prevented through IP and browser checks. On average, participants required 10-12 minutes to complete the questionnaire.

Quantitative data were processed in IBM SPSS v26 using descriptive statistics, chi-square tests, t-tests, and ANOVA, with significance set at $p < 0.05$. Open-ended responses were examined through thematic content analysis, with two coders independently identifying recurring themes such as privacy, trust, and misuse of data.

The overall methodological design, therefore, reflects a descriptive cross-sectional approach. While acknowledging limitations related to sampling bias, cultural interpretation of ethical issues, and the inability to infer causality, the study was able to collect timely and context-specific data on public awareness and ethical perceptions of neuromarketing in Kazakhstan. By situating neuromarketing tools within a comparative and integrated framework, the research not only classified technologies but also provided a foundation for analyzing attitudes toward their acceptability and ethical implications.

4. RESULTS

A total of 211 valid responses were analyzed. The sample was made up of 70.6% (n = 149) women and 29.4% (n = 62) males. The age groups were: 18-25 years (32.7%), 26-35 years (38.9%), 36-45 years (15.2%), 46-55 years (4.7%), and 56 years and older (8.5%). Most of the people who answered (78.2%) lived in cities and had college degrees (81.1%). These numbers show that the sample is well-educated yet biased against women and people from certain cities.

Only 36% of those who answered the survey knew what neuromarketing was, which shows that the public is not very aware of it. Younger adults were far more aware of the issue than older persons (44% in the 18–35 group vs. 21% in the 46+ group), χ^2 (4, N = 211) = 10.12, $p < 0.05$.

The distribution of respondents by age and gender across groups is presented in Figure 1, which combines the heatmap format to illustrate how different generations are familiar with neuromarketing.

The greatest awareness is observed among young participants aged 18-35 years. Almost every second (44%) of this category has heard about neuromarketing before.

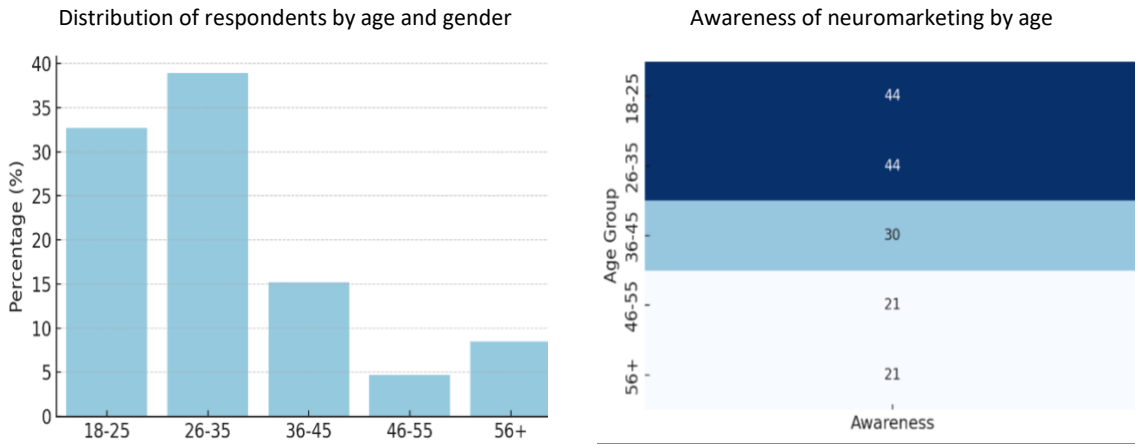

Figure 1. Distribution of respondents by age and gender, including awareness of neuromarketing across age groups

The greatest awareness is observed among young participants aged 18-35 years. Almost every second (44%) of this category has heard about neuromarketing before. At the same time, the proportion of older respondents (46 and older) who are familiar with this concept is significantly lower, amounting to only 21%. The average age group (36-45) occupies an intermediate position, while the youngest group (under 18) is the least aware. The graph clearly demonstrates a "generational gap" between younger and older generations in terms of their knowledge of modern neurotechnologies and marketing practices. This suggests a link between digital literacy and age, highlighting the need for targeted educational and awareness campaigns.

Table 3 presents these proportions with 95% confidence intervals.

Table 3. Summary of key survey proportions with 95% confidence intervals

Variable	Positive Responses (n)	Proportion (%)	95% CI Lower (%)	95% CI Upper (%)
Transparency Support	178	84.4	79.1	88.5
Privacy Concern	161	76.3	70.3	81.5
Support for Regulation	172	81.5	75.9	86.1
Support for Commercial Use	89	42.2	35.6	49.1
Support for Social Use	152	72.0	65.6	77.6
Unwilling to Participate	130	61.6	54.9	67.9

Note: compiled by authors

According to the data presented, it is clear that the respondents' attitude to neuromarketing is characterized by a high sensitivity to ethical issues. Thus, the overwhelming majority of participants expressed support for the principles of transparency is 84.4% (95% CI: 79.1-88.5), as well as the need for legal regulation – 81.5% (95% CI: 75.9-86.1), reflecting society's expectations regarding control and openness in this area. In turn, more than three quarters of the respondents identified the threat of privacy violations as one of the key risks of neuromarketing of 76.3% (95% CI: 70.3-81.5), emphasizing the importance of personal data protection. At the same time, attitudes towards various fields of application are differentiated: social practices (healthcare, education) were approved by 72.0% (95% CI: 65.6-77.6) respondents, while only 42.2% supported commercial applications (95% CI:

35.6-49.1). Finally, more than half of the participants (61.6%, 95% CI: 54.9–67.9) stated an unwillingness to personally participate in neuromarketing research, indicating a presence of distrust and wariness towards this technology. The crosstabulation of age and support for regulation showed a clear generational trend: older individuals (36-55) wanted regulatory protections the most (almost 90%), whereas younger participants (18-25) wanted them the least (74%).

Figure 2 shows how people's opinions towards regulation change with age.

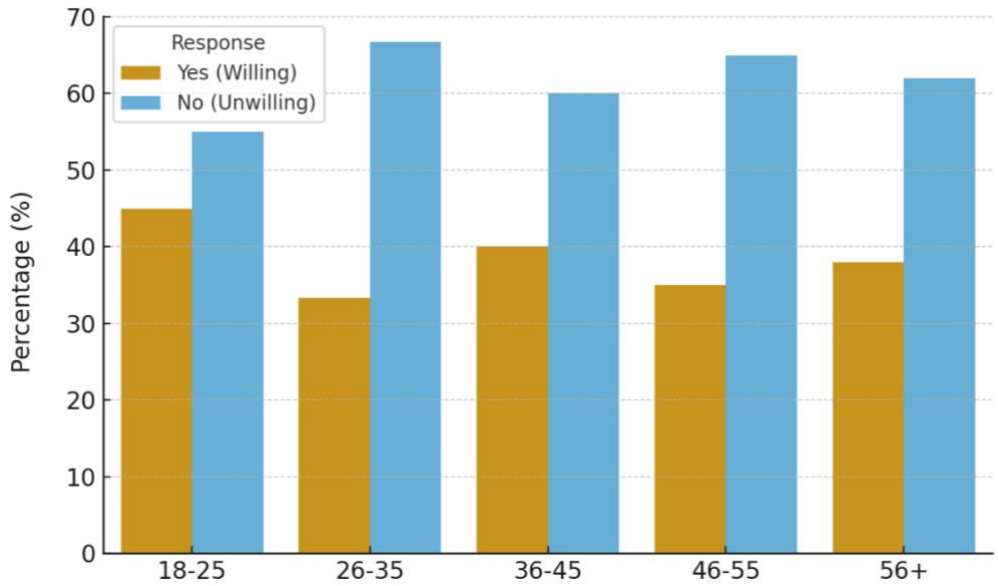

FIGURE 2. Support for regulation of neuromarketing by age group

Respondents demonstrated conditional acceptance of neuromarketing depending on age. The largest share of supporters of introducing stricter legal measures was recorded among respondents aged 36-55 years, almost 90% of participants in this group expressed willingness to support increased regulation. In younger age groups (18-25), the support level was significantly lower, at about 74%. Intermediate levels of support were observed among respondents aged 26-35 and those over 55. This dynamic confirms a distinct "generational trend" – the older respondents are, the more inclined they are to support legal regulations in neuromarketing. These results indicate differences in risk perception and institutional trust: older generations are more cautious and focused on formal control, whereas younger participants are less supportive of stricter regulations.

People were not very willing to take part in neuromarketing studies. Most of them (61.6%) said they didn't want to because they were worried about privacy and how their data will be used. The youngest respondents (26-35) were the most hesitant (66.7%), which suggests that being digitally literate doesn't always mean trusting neurotechnological research.

The data together underscore three major patterns. First, ethical awareness is strong, and openness, privacy, and rules are all things that must be met to be accepted. Second, the context in which an application is used is important. Socially orientated behaviours are seen as genuine, while profit-driven commercial applications make people suspicious. Third, age, not gender, affects attitudes. Older participants are more likely to want to follow the rules, while younger groups are less likely to want to get involved directly. These results confirm that people in Kazakhstan still only embrace neuromarketing if they are sure, it is ethical. In addition to descriptive statistics, χ^2-tests were utilised to investigate potential

correlations between demographic variables and attitudes towards neuromarketing. The investigation confirmed that gender was not a significant determinant of support for transparency, privacy concerns, or willingness to engage. For instance, the level of support for transparency was comparably high among women (86.6%) and men (79.0%), χ^2 (1, N = 211) = 1.36, p = 0.243 (refer to Table 4).

Table 4. Chi-square test result: gender vs. transparency support

Comparison	Women supporting (%)	Men supporting (%)	Chi-square	Degrees of Freedom	p-value	N
Gender vs. Transparency	86.6	79.0	1.36	1	0.243	211

Note: authors' calculations based on survey data

This suggests that ethical ideas are broadly held by both genders, with no systematic variation. In contrast, age became a critical element. Older participants were more inclined to advocate for regulatory protections in contrast to younger cohorts ($p < 0.05$). Specifically, more than 90% of people between the ages of 36 and 55 said they supported regulation, but only around 74% of people between the ages of 18 and 25 said the same thing. This pattern suggests a generational disparity in regulatory expectations, possibly indicating increased institutional trust or risk aversion among older individuals.

The inferential analysis shows several important patterns when looked at as a whole. To begin with, ethical sensitivity is always high, with more than three-quarters of the sample wanting privacy, openness, and rules that are fair. Second, the acceptability of neuromarketing seems to depend on the situation. Respondents make a clear difference between socially sound uses (such as health or education campaigns) and commercial uses, which are viewed with scepticism. Third, there is a digital literacy gap: younger professionals are more aware of neuromarketing, but they are also hesitant to get involved, which could be due to their heightened awareness of privacy risks. Lastly, the lack of gender effects and the existence of a significant age impact suggest that regulation is the most age-sensitive ethical domain. In summary, these results emphasise that a blend of cautious knowledge and pervasive ethical concern characterises public opinion in Kazakhstan. When connected to social value, neuromarketing is more acceptable, but it is still met with scepticism and mistrust, especially among younger, educated persons.

5. DISCUSSIONS

This study provides the first systematic empirical analysis of public perceptions and ethical attitudes toward neuromarketing in Kazakhstan. The findings make a meaningful contribution to the global discourse on the ethical, legal, and societal dimensions of neuromarketing in emerging economies. Our results confirm that public awareness of neuromarketing in Kazakhstan is low, with only 36% of respondents indicating prior familiarity with the concept. This echoes findings from other developing contexts (Khondakar et al., 2024; Fauzi et al., 2022), where the diffusion of neuroscientific concepts and technologies remains limited due to lower digital literacy and limited public discourse (Whitsel & Merrill, 2021). At the same time, ethical concerns, ethical concerns, particularly related to privacy, manipulation, and the need for regulation, were strongly expressed. Over three-quarters of respondents supported the principles of transparency and privacy in neuromarketing practices. These concerns align with global trends observed in Europe, the United States, and Asia, where public trust depends heavily on the perceived safety and integrity of neurodata processing (Christensen et al., 2022; Ulman et al., 2015; Goncalves et al., 2024).

Notably, Kazakhstani respondents clearly distinguished between commercial and social

uses of neuromarketing. While only 42% approved of its use for commercial purposes, 72% expressed support for socially beneficial applications, such as public health and education campaigns. This context-dependent acceptance aligns with international studies, which demonstrate that public support is higher when neuromarketing is perceived as serving the common good (Luna-Nevarez, 2021; Tomková & Zbihlejová, 2023). Despite this recognition of social value, reluctance to participate in neuromarketing studies was high (over 61%), particularly among younger adults and respondents with higher education levels. Privacy concerns, the absence of clear regulatory frameworks, and fears of manipulation were the most frequently cited reasons. This finding reflects a broader pattern of mistrust found in other transitional societies, where weak legal protections and a lack of transparency aggravate public scepticism (Harrell, 2019; Whitsel & Merrill, 2021).

No statistically significant gender-based differences were observed in attitudes toward transparency or privacy. However, age emerged as a relevant factor: older respondents were more likely to demand stronger regulatory safeguards. This finding may reflect generational differences in institutional trust and risk perception, as reported in recent neuroethics literature (Goncalves et al., 2024).

This study offers several original contributions to the field:

1. Empirical Baseline: It establishes the first data-driven baseline for public awareness, ethical concerns, and participation attitudes regarding neuromarketing in Kazakhstan, an under-researched region in this context.

2. Contextualized Insight: By contrasting commercial and social applications, the study reveals a nuanced public perspective: ethical acceptability is conditional and driven by perceived social benefit rather than profit motive.

3. Policy and Regulatory Relevance: The strong demand for privacy and legal protections provides actionable guidance for policymakers. Kazakhstan could benefit from reforms similar to those under the EU's GDPR or UNESCO's AI ethics guidelines, including explicit regulation of neurodata and informed consent mechanisms.

4. Comparative Perspective: While Kazakhstan shares key trends with the global landscape, such as low awareness and high ethical sensitivity, it also demonstrates distinct features, most notably, the coexistence of high educational attainment and persistent distrust in commercial neuroscience.

This study makes several original contributions to the field. It establishes the first data-driven baseline for public awareness, ethical concerns, and participation attitudes regarding neuromarketing in Kazakhstan, a region that has so far been under-researched in this context. By contrasting commercial and social applications, the study reveals a nuanced public perspective in which ethical acceptability is conditional and largely driven by perceived social benefit rather than profit motives. The strong demand for privacy and legal protections provides actionable guidance for policymakers, suggesting that Kazakhstan could benefit from reforms similar to those under the EU's GDPR or UNESCO's AI ethics guidelines, with explicit regulation of neurodata and informed consent mechanisms. At the same time, the findings highlight that, while Kazakhstan shares global trends such as low awareness and high ethical sensitivity, it also demonstrates distinct local features, most notably the coexistence of high educational attainment and persistent distrust in commercial neuroscience.

The study, however, has several limitations. The use of snowball sampling and the overrepresentation of urban, highly educated, and female participants limit the generalizability of the results. Reliance on self-reported data may introduce social desirability bias and inaccuracies of recall, while the cross-sectional design captures only a snapshot in time and cannot reflect the potential evolution of public attitudes as neuromarketing practices and regulations develop. Furthermore, the use of a predominantly closed-ended questionnaire restricts the exploration of more complex or ambivalent opinions that could be uncovered

through qualitative methods. Future research should therefore aim to overcome these constraints by employing probabilistic sampling, integrating mixed-method approaches such as interviews and focus groups, and adopting longitudinal designs to capture evolving perceptions and to better understand the drivers of ethical reasoning.

The findings also carry practical implications. For policymakers, they highlight the urgency of modernizing national data protection laws to explicitly include provisions for neurodata, informed consent, and international data transfer standards. For researchers, they point to the importance of developing public outreach and education initiatives aimed at raising awareness and improving understanding of neuromarketing. For the industry, they underscore the necessity of adhering to internationally recognized ethical codes, such as those of the NMSBA, and ensuring that all neuromarketing studies are conducted with rigorous consent and privacy protocols.

The results of the research suggest practical steps that may be taken by policymakers, researchers, and industry representatives.

(1) For policymakers: Modernize national data protection laws to explicitly include provisions for neurodata, informed consent, and international data transfer standards.

(2) For researchers: Develop and implement public outreach and education initiatives aimed at increasing awareness and understanding of neuromarketing.

(3) For the industry: Adopt internationally recognized ethical codes (e.g., those of the NMSBA) and ensure that all neuromarketing studies adhere to rigorous consent and privacy protocols.

In conclusion, the discussion demonstrates that public perceptions of neuromarketing in Kazakhstan are shaped by limited awareness, strong ethical concerns, and context-sensitive acceptance. While Kazakhstan shares global trends, it also exhibits distinct local dynamics, particularly the intersection of higher education and low trust in commercial applications. These findings offer a valuable basis for developing ethical standards, regulatory reforms, and inclusive communication strategies tailored to emerging digital markets.

6. CONCLUSIONS

This study represents the inaugural empirical investigation of public perceptions and ethical issues associated with neuromarketing in Kazakhstan, thus filling a research gap in Central Asia. The analysis revealed that public awareness of neuromarketing is relatively low, while ethical concerns are prevalent and deeply ingrained, especially regarding transparency, privacy, and the potential for manipulation. The findings indicate that attitudes towards applications are context-dependent; socially beneficial uses in healthcare and education received higher approval, whereas commercial applications were met with increased scepticism. The results indicated that gender differences were not significant, while age emerged as a critical factor, with older respondents consistently advocating for stronger regulatory safeguards.

This research is original in that it offers nationally specific survey data from a context that has not been previously explored in the international literature. This study offers new insights into the articulation of ethical concerns within an emerging market, emphasising transparency, informed consent, and regulatory expectations as fundamental areas of public sensitivity. The findings have significant implications for policymakers tasked with modernising data protection legislation to explicitly address neurodata use, as well as for practitioners who must prioritise transparent methodologies and clear consent procedures to foster trust. This also provides opportunities for researchers, particularly regarding the design of probabilistic sampling, qualitative extensions, and longitudinal approaches that would enhance the understanding of the evolution of public attitudes.

Despite limitations associated with sampling bias and the predominance of urban respondents, the study provides a relevant and contextually informed perspective on the

perception of neuromarketing in Kazakhstan. The findings indicate that despite persistent scepticism and mistrust, the implementation of stringent regulations, transparent practices, and inclusive public engagement could facilitate the ethically responsible integration of neuromarketing within the broader context of the country's digital transformation. Aligning international standards with local cultural and ethical expectations allows the field to evolve in a socially responsive and scientifically rigorous manner.

AUTHOR CONTRIBUTION

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