Ш. Уәлиханов атындағы КУ хабаршысы. Филология сериясы. № 1 2025
Вестник КУ имени Ш.Уалиханова. Серия филологическая. № 1, 2025
ISSN 2788-7979 (online)

Bulletin of S.Ualikhanov KU.
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## LEXICAL AND SEMANTIC ANALYSIS OF THE NEUROTECHNOLOGY TERMINOLOGY IN PODCASTS

*This article explores how podcasts, as a modern media communication genre, contribute to the formation, adaptation, and popularization of neurotechnology terminology on popular platforms such as "YouTube", "www.litres.ru" and "Podcasts.lab" among a broad audience.*

*In the era of globalization and the rapid development of technology, the emergence of new scientific terms demands effective integration into everyday language. Podcasts offer a valuable means for non-experts to grasp complex terms in an accessible and engaging manner.*

*The aim of this study is to analyze the lexical and semantic characteristics of neurotechnology terminology in podcasts, identify strategies for adapting specialized vocabulary, and compare the effectiveness of different podcast formats in popularizing scientific knowledge.*

*The scientific novelty of the study lies in considering podcasts as a genre of media discourse that contributes to the formation and dissemination of neurotechnology terminology — a topic that has not been previously explored from a linguistic perspective.*

*To achieve the research aim, quantitative and qualitative methods were used, including lexico-semantic analysis, content anaysis, and comparative analysis.*

*Podcasts were selected based on criteria such as popularity, topic relevance and format (in this study, podcast-monologue and podcast-interview).*

*Audio and video materials were transcribed using the "Taguette" and "Python" programs, the coding process facilitated by "QualCoder" software. Terminological units were categorized according to the their lexical and semantic characteristics (e.g., borrowings, neologisms, blendings, calques, abbreviations, etc.).*

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Вестник КУ имени Ш.Уалиханова. Серия филологическая. № 1, 2025          Philological Series. № 1, 2025
ISSN 2788-7979 (online)

*Content analysis was conducted to identify the frequency of terms, their explanations, and the use of real-life examples. In the final stage, the podcast formats were compared. The program "Miro" was used to visualize the results.*

*The findings of this study can serve as a valuable resource for specialists in lexicography and will also be useful for a broad audience specialized training or knowledge in the field.*

*Key words: neurotechnology, podcast, cyborgization, digitalization, brain-computer interface, nanotechnology.*

## MAIN PROVISIONS

Terminology studies explore issues related to terms in language. In linguistics, there is no universally accepted definition of the term. The concept originates from the Latin word *terminus*, meaning "boundary" or "limit."

The key distinction between terms and other lexical units is that they designate precisely defined concepts, phenomena, or objects.

Terminology refers to both the set of terms within a specific field of knowledge and the branch of linguistics that investigates the function and formation of terms. One of the primary sources in the development of terminological system is the borrowings. This phenomenon occurs across all disciplines, each of which maintains its own terminological system and specialized vocabulary.

Any lexical unit introduced from one language into another does not remain unchanged; rather, it undergoes a certain degree of adaptation over time.

According to S.V. Grinev-Grinevich, this process involves the assimilation of the borrowed lexeme by the recipient language through its phonetic, graphic, grammatical, and lexico-semantic characteristics to the norms of the target language [1, 74-75].

The use of terminology across various media genres largely depends on the goals, target audience, and formats. For example, scientific articles are characterized by a strict, formal style, and terms usually adhere to established academic standards. In contrast, blogs offer a more informal platform where authors can express personal opinions and share experiences.

Social networks are known for their brevity and informal communication, where colloquial expressions, slang, and emoticons are commonly used. In such cases, scientific terms may be simplified or abbreviated for easier comprehension, sometimes leading to linguistic interference.

Podcasts, however, occupy a special place among media platforms. They represent a hybrid format, where scientific terms can be used in both academic and conversational styles, depending on the topic and the target audience.

Nowadays the emergence of new genres is closely linked to the rapid development of Internet communication.

A review of theoretical literature indicates a lack of consensus among scholars regarding the classification of Internet communication genres. Commonly recognized genres include emails, forums, chats, blogs, social networks, and virtual conferences.

According to S. Herring [2, 144-147] blogs are defined as "frequently updated web pages where dated entries are displayed in reverse chronological order".

A more comprehensive definition is provided by M.Yu. Sidorova, who describes a blog as "a website containing dated multimedia entries arranged in reverse chronological order, with the ability to comment on posts and view each entry on a separate webpage" [3, 193].

The classification of blogs is offered by Scott Nowson, who distinguishes between *news blogs*, *commentary blogs*, and *journal blogs* [4, 279 ].

Rebecca Blood further refines this classification by identifying three types of blogs based on content: *filter blogs* (describing global and online events), *personal journals* (reflecting the author's thoughts and experiences), and *hybrid diaries*, which combine features of both [5, 114-120].

In addition to the term *blog*, synonyms such as *Internet diary* and *online diary* are also used; however, *blog* remains the most widely accepted term.

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ISSN 2788-7979 (online)

Bulletin of S.Ualikhanov KU.
Philological Series. № 1, 2025

The stylistic characteristics of professional blogs include the use of journalistic and conversational functional styles, as well as various expressive linguistic devices and techniques. Blog posts often incorporate hyperlinks to social media platforms, enabling readers to share content with their networks. (e.g.: Subscribe me. Share with this post. Leave comments. Click like etc.).

Authors frequently utilize direct address techniques and imperative constructions to enhance communication with their readers.

While blogs provide in-depth content, social media platforms offer faster, interactive communication, allowing users to engage with content in real time.

The term *social media* is frequently equated with *social networks*; however, it is also commonly used as a synonym for *new media*.

The concept of a *social network* was introduced by Norwegian sociologist James Barnes in 1954, referring to a circle of acquaintances, partners, or professional connections.

Matthews defines social media as "a set of network technologies, practices, or communities that people use to create content and exchange opinions, ideas, experiences, and perspectives with one another" [6, 17-19].

In his book *We the Media*, Dan Gillmor argues that the blogosphere exerts a greater societal influence than traditional media, as audiences tend to place more trust in bloggers than in professional journalists [7].

New media generally encompass the following:
• Online media (Internet-based media), including digital versions of traditional offline media;
• Podcasting services (Internet radio);
• Streaming services (streaming media), such as Internet television and online broadcasting;
• Mobile television;
• Social media (social networks);
• Blogging and microblogging platforms.

While social media facilitates rapid interaction, scientific texts prioritize detailed, structured dissemination of knowledge.

Scientific texts are characterized by logical reasoning, sequential and objective narration, and clearly defined concepts and phenomena, ensuring coherence and logical connections between statements.

Terminology in scientific discourse must be devoid of emotional connotations. Specialized language, in general, differs from everyday language in multiple aspects, including writing conventions, vocabulary, syntax, and semantics. However, they permit extensive borrowing, the formation of neologisms, and the use of compound nouns.

The following table provides a comparative analysis of different formats in terms of their characteristics and the way they present neurotechnology concepts:

Table 1 The key differences between the media formats

| № | Criteria | Podcasts | Videos | Blogs | Articles |
|---|---|---|---|---|---|
| 1 | **Format** | Audio and video | Visual + Audio, engaging | Written, sometimes interactive | Formal, scientific, structured |
| 2 | **Complexity of Terminology** | Simplified, often with analogies | Simplified, supported by visuals | Varies, but can be simplified | Highly technical, precise terminology |
| 3 | **Style of communication** | Casual, friendly, conversational style | Can be either entertaining or serious | More formal, but accessible | Formal, scientific, precise |
| 4 | **Visual elements** | - | | May include images, graphs | Limited visuals, primarily graphs |

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| | | Graphics, animations, diagrams | | |
|---|---|---|---|---|
| 5 | **Interactivity** | Q&A, comments | Comments and discussions, feedback | Discussion in comments | No direct interactivity |
| 6 | **Target audience** | General public, some experts | General audience | Diverse audience, from enthusiasts to professionals | Researchers, academics |

Many fields adhere to specific term formation rules that categorize objects or concepts within a given domain. For example, the names of electronics follow a pattern based on the number of electrodes they contain (e.g., *diode, triode, tetrode, pentode, hexode, heptode*); certain electronic devices incorporate the suffix "-tron" (e.g., *additron, carcinotron, cryotron, excitron*).

## INTRODUCTION

This study investigates the neurotechnology terminology used in podcasts. The primary focus is on the lexical and semantic analysis of neurotechnology terminology, examining how these terms are adapted and popularized in podcast discussions.

To achieve this, the following objectives were set:

-to identify the lexical and semantic characteristics of terms used in podcasts;

-to analyze syntactic features of neurotechnology terminology;

-to compare the use of terminology in "podcast-monologue" and "podcast-interview" formats;

The choice of podcasts as the research object highlights the potential to bridge the gap between scientific discourse and everyday communication, making podcasts an effective tool for popularizing neurotechnology terminology.

The subject of the study is the lexical and syntactic characteristics of neurotechnology terminology in podcasts.

The scientific novelty of this study lies in the exploring podcasts as a form of popular science content. While podcasts have been widely examined in modern media research, their role in disseminating neurotechnology terminology has not yet been analyzed from a linguistic perspective.

Hypothesis: Neurotechnology podcasts are an effective tool for popularizing scientific terms and simplifying complex concepts, thereby enhancing their comprehension and accessibility for a broad audience.

Podcasts play a crucial role in simplifying complex terminology for a broader audience. In contemporary media platforms, podcasts have become one of the most popular communication genres. The term "podcast" consists of two parts: "iPod" and "broadcasting", and can be interpreted as a modern speech genre in the form of digital audio and video recordings posted via social networks.

The concept of a podcast was first introduced by The Guardian journalist Ben Hamersley. In 2005, the word "podcast" was recognized as the word of the year and added to the Oxford English Dictionary.

According to the Podcast Index 2024, the number of podcasts has reached 4 million [8]. Podcasts have become an integral part of the media platform, enabling people to share thoughts, ideas, stories, and life experiences.

Since 2020, there has been noticeable growth in the podcast industry in Kazakhstan. However, the podcast listening culture in the country is still in development, and many people are yet to fully understand the concept of podcasts as a "talking Netflix."

Experts attribute the rising popularity of podcasts to the emergence of media and brands in the market, as well as the launch of new projects. Examples include the historical audio podcast "Khancast", initiated in 2022, which is dedicated to the lives of Kazakh khans, business and startup podcasts, and the Ecological Fund of Kazakhstan's podcast series launched in 2023, covering various environmental topics.

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Foreign researchers such as Jemily Rime, Chris Pike, and Tom Collins have examined the six-tensions framework for podcasting innovation. This framework highlights the balance between six conceptual tensions: Art-Technology, Immersion-Interactivity, Automation-Personalisation, Universal-Unique, Mainstream-Independent, and Current audience-Possible demographics. Further research is needed to explore these conceptual pairings to better understand how podcasting influences audiences. [9, 3-23].

Additionally, studies by Tobin SJ and Guadagno RE indicate that podcast listeners tend to engage in information-seeking behavior and show lower levels of neuroticism compared to non-listeners. [10, 2-16].

The educational benefits of podcasts have been demostrated in the study "Podcasting as a tool to take conservation education online", which confirmed that podcasts can effectively serve as an audio-lingual method for learning new material, improving listening and speaking skills, and acting as a motivational tool [11, 3-10].

Due to their accessibility and convenience, podcasts play a key role in the educational process, providing listeners with the opportunity to familiarize themselves with new scientific developments and terminology. This is particularly important in the context of neurotechnology, where podcasts serve as an essential medium for disseminating knowledge to a broader audience.

## MATERIALS AND METHODS

This investigation is based on both qualitative and quantitative methods. The selection of 15 podcasts was based on several key criteria. Firstly, they address the topic of neurotechnology and provide relevant, up-to-date information, which is confirmed by the number of listens and audience feedback. Secondly, all podcasts were published in recent years (2020-2024), ensuring their relevance to contemporary discussions in the field. Additionally, the focus on podcasts from experts and scientific institutions, ensuring a high level of scientific value.

For comprehensive analysis, both interview-based and monologue-based podcasts were included.

Thus, the selected podcasts combine relevance, popularity, expert insights, and diverse formats, making them suitable for analysis within this study.

All podcasts in Russian and English were selected from the platforms "Youtube", "www.litres.ru", and "Podcasts.lab" with a total duration of approximately 12 hours. As a result, 173 terms were collected.

At the first stage of the study, some podcast videos were converted into audio files. We used "Taguette" and "Python" programs to transcribe the audio materials from the neurotechnology podcasts. This tool allows for automatic speech-to-text conversion with high accuracy, thus speeding up the analysis process. These programs analyzed approximately 20 seconds of the podcast episode in 3 minutes. We selected the "Processing and Recognition" tab and generated the transcribed text.

After transcribing each podcast, we manually reviewed the texts to eliminate mistakes before conducting further linguistic analysis. The transcriptions were saved in .txt format. It should be noted that we selected podcasts with high sound quality to minimize transcription errors.

The obtained transcriptions were imported into the "QualCoder" program for frequency analysis. This program is used for both qualitative and quantitative text analysis, including calculating the frequency of terms and encoding them.

In the process of analyzing the podcasts for neurotechnology terminology, the "QualCoder" software was utilized to facilitate the coding and categorization of terms. Initially, the transcribed podcast text was imported into the "Document System" tab. The primary task was to identify terms relevant to neurotechnology and assign them appropriate codes. During the reviewing of the transcriptions, terms were highlighted and coded accordingly.

To further refine the analysis, subcategories were added to classify the terms based on their formation methods. These categories included:

- Borrowing

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ISSN 2788-7979 (online)

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- Neologisms
- Jargon
- Abbreviation
- Loanwords et.c.

Each term was assigned to the corresponding category, depending on its origin. For example, terms borrowed from other languages were labeled under "borrowing," while newly coined terms were classified as "neologisms." This method allowed for a systematic organization of the terms and provided insight into how different terms were formed.

Content analysis was used to identify the meanings of each fragment using the following criteria:

- Frequency of term usage;
- Phrases and word combinations used to explain specific terms;
- Real-life examples provided by podcast authors.

Comparative analysis. To determine the differences between "podcast-monologue" and "podcast-interview", a comparative analysis was conducted based on the following:

- Speech samples (formal, informal style);
- Information presentation structure (narrative story, Q&A format);
- Explanation of terminology.

This analysis is particularly useful for studying and identifying which podcast format is more effective for popularizing terminology.

For a visual representation of concepts, a terminological map was created using the "Miro" program. This map includes key terms presented in podcasts within the field of neurotechnology. The research material consists of podcasts on neurotechnology. Table 2 shows the characteristics of podcasts within the field of neurotechnology.

Table 2 – Characteristics of podcasts within the field of neurotechnology

| № | Channel name | Podcast topic | Duration | Type of podcast | Author | Link to podcast |
|---|---|---|---|---|---|---|
| 1 | Radio Svoboda | Neurotechnology: People have the right | 28:23 mins 2 July, 2024 | Interview | Alexey Grinbaum | https://www.youtube.com/watch?v=Q_Wl7ShTMoo |
| 2 | RationalAnswer | How ChatGPT works: explaining neural networks simply | 39:03 mins 5 April, 2023 | Monologue | Pavel Komarovsky | https://www.youtube.com/watch?v=VVfFf_XW8zw |
| 3 | Huberman Lab | How psilocybin can rewire our brain | 2 hours 09 mins 8 May, 2023 | Monologue | Andrew Huberman | https://www.youtube.com/watch?v=eIxVfln02Ss |
| 4 | Dovedem do uma | Neural network is changing human live | 43:10 mins 8 August, 2022 | Interview | Irina Temolova | https://www.youtube.com/watch?v=Avb261AMclQ |
| 5 | ProNauku | How neurotechnology will change the future | 20:45 mins 19 October, 2023 | Interview | Michael Lebedev | https://www.youtube.com/watch?v=jjCHQV_GQSI |
| 6 | TED технологии | A powerful new neurotechnology tool for augmenting your mind | 13 mins 27 June, 2023 | Monologue | Konor Russomanno | https://podcasts.apple.com/kz/podcast/tedtalks-%D1%82%D0%B5%D1%85%D0%BD%D0%BE%D0% |

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| | | | | | BB%D0%BE%D0%B3%D0%B8%D0%B8/id625536364?i=1000639539263 |
|---|---|---|---|---|---|
| 7 | The Future of Neurotechnologies | Brain Analysis Headphones | 42 mins<br><br>27 February, 2024 | Interview | Alexander Panov | https://podcasts.apple.com/kz/podcast/%D0%B0%D0%BA%D1%82%D0%B8%D0%B2%D0%BD%D1%8B%D0%B9-%D0%BF%D1%80%D0%B5%D0%B4%D0%BF%D1%80%D0%B8%D0%BD%D0%B8%D0%BC%D0%B0%D1%82%D0%B5%D0%BB%D1%8C-%D0%BD%D0%B0-%D1%83%D0%BC%D0%BD%D0%BE%D0%BC-%D1%80%D0%B0%D0%B4%D0%B8%D0%BE/id1765457277?i=1000666982980 |
| 8 | Neurocast | Neurorehabilitation: How Neurotechnologies Help Maintain Motivation During Difficult Periods | 55 mins<br><br>20 September, 2020 | Interview | Anton Ivanov | https://podcasts.apple.com/kz/podcast/%D0%BD%D0%B5%D0%B9%D1%80%D0%BE%D0%BA%D0%B0%D1%81%D1%82/id1533814547?i=1000493134408 |
| 9 | Neurocast | Neurotechnologies & VR for Retail (Neuromarketing) | 1 h, 11 mins<br><br>27 October, 2023 | Interview | Rustam Rzaev | https://podcasts.apple.com/kz/podcast/neurocast/id1618426770?i=1000632743232 |
| 10 | Transhumanism | Neurotechnology and the occult | 14 mins<br><br>2 August, 2022 | Monologue | - | https://podcasts.apple.com/kz/podcast/the-new-world-order-agenda-2030-agenda-2045-agenda/id1612549213?i=1000574771087 |
| 11 | The state of Medtech | Neuro: Digitizing the brain using AI | 1 h, 34 mins<br><br>27 June, 2023 | Monologue | Michael Sughrue | https://podcasts.apple.com/kz/podcast/state-of-medtech/id1597688404?i=1000618648396 |
| 12 | Neurable | On building neurotech tools | 23 mins | Monologue | Adam Molnar | https://podcasts.apple.com/kz/podcast/forward-thinking-founders/id145416 |

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| | | | 23 November, 2020 | | | 8902?i=100049994 5049 |
|---|---|---|---|---|---|---|
| 13 | Neurocast | Neurotechnologies in Research | 1 h, 8 mins<br><br>8 September, 2022 | Interview | Valery Raevskaya | https://itunes.apple. com/WebObjects/ MZStore.woa/wa/v iewPodcast?id=161 8426770&i=10005 78735583 |
| 14 | Periodic effect cannabis science podcast | Neurotechnology can quantify cannabis psychoactive effects | 38 mins<br><br>28 April, 2022 | Interview | Israel Gasparin | https://itunes.apple. com/WebObjects/ MZStore.woa/wa/v iewPodcast?id=128 9047409&i=10005 58910830 |
| 15 | Paradigm podcast | Consciousness physics and neurotechnology | 1 h, 30 mins<br><br>13 August, 2024 | Monologue | Christof Koch | https://podcasts.app le.com/kz/podcast/ paradigm/id168901 4059?i=100066508 1917 |

Some of the selected podcasts focus on the application of neurotechnology and its impact on human life. For instance, the podcasts *"Neurotechnology: People Have the Right"* and *"How Neurotechnology Will Change the Future"* discuss the ethical, legal, and societal implications of neurotechnology, discussing concerns such as privacy, personal data, and the broader social consequences. Similarly, *"Neural Network is Changing Human Life"* and *"Neuro: Digitizing the Brain Using AI"* explore how neural networks and artificial intelligence are transforming sectors like healthcare, business, and various other domains of everyday life.

The popularity of these podcasts, reflected in their millions of views and subscribers, indicates the high public interest in neurotechnology. This widespread engagement signals an increasing curiosity about the advancements in this field. For example, the podcast *"A Powerful New Neurotechnology Tool for Augmenting Your Mind"* has garnered an impressive 1.47 billion views, marking it as a notable success.

Other episodes, such as *"How ChatGPT Works: Explaining Neural Networks Simply"* and *"How Psilocybin Can Rewire Our Brain"*, have accumulated between 1.5 and 2 million views, signifying their strong appeal.

However, podcasts like *"Neural Network is Changing Human Life"* and *"How Neurotechnology Will Change the Future"* attract a smaller audience, with viewership at 163,000 and 233,000 respectively. This gap can be explainde by the format and content of the episodes.

Overall, the viewership and engagement levels of these podcasts not only highlight the growing interest in neurotechnology but also illustrate how different formats - such as interviews and monologues – attract different demographic groups of listeners.

RESULTS

The analyzed neurotechnology podcasts are characterized by the following features.
1.The linguistic characteristics:
-Jargon usage: The term *"to hack the brain"* is borrowed from a computer jargon, where *"hack"* refers to breaching a computer security system. This usage simplifies complex concepts, making them more relatable.
-Neologisms: Terms such as *"neurohacker"*, *"neuro", and "neurable"* reflect emerging technological trends.
-Idiomatic expressions: Phrases like *"sound the alarm"*, and *"put in jeopardy" a*dd expressiveness to the narrative.

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-Calques: Terms such as *"decode"*, *"brain-computer interface"*, *"brain-data"*, *"human cognition"*, *"closed-loop system"*, *"multimodal bio-sensing headset"*, and *"digital potentiometer"*. highlight cross-linguistic influences.

-Code-switching: Phrases such as *"science fiction"* (на уровне сайнс фикшн), *"это самая лучшая работа ever",* and *"закенселят"* introduce colloquial phrases, enhancing the informal style.

-Borrowing: Terms *"language models"*, *"generative pre-trained transformer"*, *"retail"*, *"cognitive dissonans"*, *"neuro big data",* and *"neuronet"* demonstrate the impact of English on the Russian lexicon.

-English loanwords: Words such as *"AI alignment"*, *"chat GPT"*, *"feedback"*, *"microbiome"*, *"electrodes"*, *"virtual joystick"*, *"chips",* and *"digitalization"* integrate technological concepts into everyday speech.

-Blending*:* The term *"mathmodel" (*shortened from *"mathematical model")* is an example of blending, where two words are combined to form a new term.

-Abbreviations and shortenings: Examples unclude *"LLM" stands for Large Language Models"*, *"AI" (Artificial Intelligence)*, *"VR headset (Virtual Reality)*, *"AR headset (Augmented Reality),"nano"* (nanotechnology)*, "neuro"* (neurotechnology).

-Phraseological units: Phrases like *"for the time being"* and *"keeping up with the times"* are used for clarity and emphasis.

-Scientific terminology: Terms such as *"neural network"*, *"language models"*, *"quantum physics"*, *"promts"*, *"dendrite"*, *"neurogenesis"*, *"alphator system"*, *"cochlear implant"*, *"neuromarketing"*, *"artificial intelligence"*, *"VR headset"*, *"non-invasive technology"*, *"electrodes"*, *"sensors"*, *"nanotechnology",* and *"neuro-linguistic programming"* are key concepts in the neurotechnology field.

Authors use various linguistic strategies to simplify specialized terms, making them more accessible to everyday language. The use of informal language fosters a friendly atmosphere, while scientific terminology may pose challenges for non-specialists. However, explanatory techniques, such as translations and analogies, facilitate comprehension.

2. Syntactic characteristics:

-Question-and-answer structure: Podcast interviews often employ this format to create logical and interactive discussions.

-Redundancy*:* Phrases such as *"As far as I concerned"*, *"I think I understand"*, *"I see, I see",* and *"I understand now"* indicate the gradual assimilation of information.

-Colloquial expressions: Expressions such as *"you know"*, *"like"*, *"well"*, *"so"*, *"actually"*. *"Устраивайтесь поудобнее, я расскажу вам так, чтобы понял даже шестилетний гуманитарий". "Поехали! Приготовьтесь услышать страшную правду". "Олдовые телефоны". "Ну, давайте, прикинем". "Довольно-таки удивительно, согласитесь? ". "Раскабаневшая модель". "Я прямо вангую"* help create a closer atmosphere with the audience, soften sophisticated topics, and reduce the barrier between the expert and the listener.

The lexical and semantic characteristics above play an important role in explaining complex scientific terms, making science more engaging and accessible.

Table 3 presents the frequency of terms used within the field of neurotechnology.

Table 3 – Frequency of terms used in podcasts

| № | Neurotechnology terminology | Category | Frequence | Percentage |
|---|---|---|---|---|
| 1 | Brain-computer interface | Calque | 23 occurrences | 13,3% |
| 2 | Artificial intelligence | Borrowing | 26 occurrences | 15% |
| 3 | VR headset | Abbreviation VR (Virtual Reality) | 10 occurrences | 5,7% |
| 4 | Neurobiology | Borrowing | 11 occurrences | 6,3% |
| 5 | Digital twin | Calque | 12 occurrences | 6,9% |
| 6 | Cyborgization | Neologism | 9 occurrences | 5,2% |

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Philological Series. № 1, 2025
ISSN 2788-7979 (online)

| 7  | Eye-tracking                      | Calque                     | 9 occurrences  | 5,2% |
|----|-----------------------------------|----------------------------|----------------|------|
| 8  | Invasive neurotechnical devices   | Borrowing                  | 11 occurrences | 6,3% |
| 9  | Neurohacking                      | Neologism                  | 9 occurrences  | 5,2% |
| 10 | Human cognition                   | Borrowing                  | 12 occurrences | 6,9% |
| 11 | Neuromarketing                    | Blending                   | 8 occurrences  | 4,6% |
| 12 | Exoskeleton                       | Borrowing                  | 5 occurrences  | 2,8% |
| 13 | Neurable                          | Neologism (neuro+able)     | 8 occurrences  | 4,6% |
| 14 | Microelectrods                    | Borrowing                  | 7 occurrences  | 4%   |
| 15 | Cannabinoid                       | Borrowing                  | 7 occurrences  | 4%   |
| 16 | Bioprotheses                      | Jargonism                  | 14 occurrences | 8%   |
| 17 | BBI (Brain-to-Brain Interface)    | Abbreviation               | 9 occurrences  | 5,2% |
| 18 | EEG (Electroencephalography)      | Abvreviation               | 9 occurrences  | 5,2% |
| 19 | Bug                               | Jargonism                  | 7 occurrences  | 4%   |

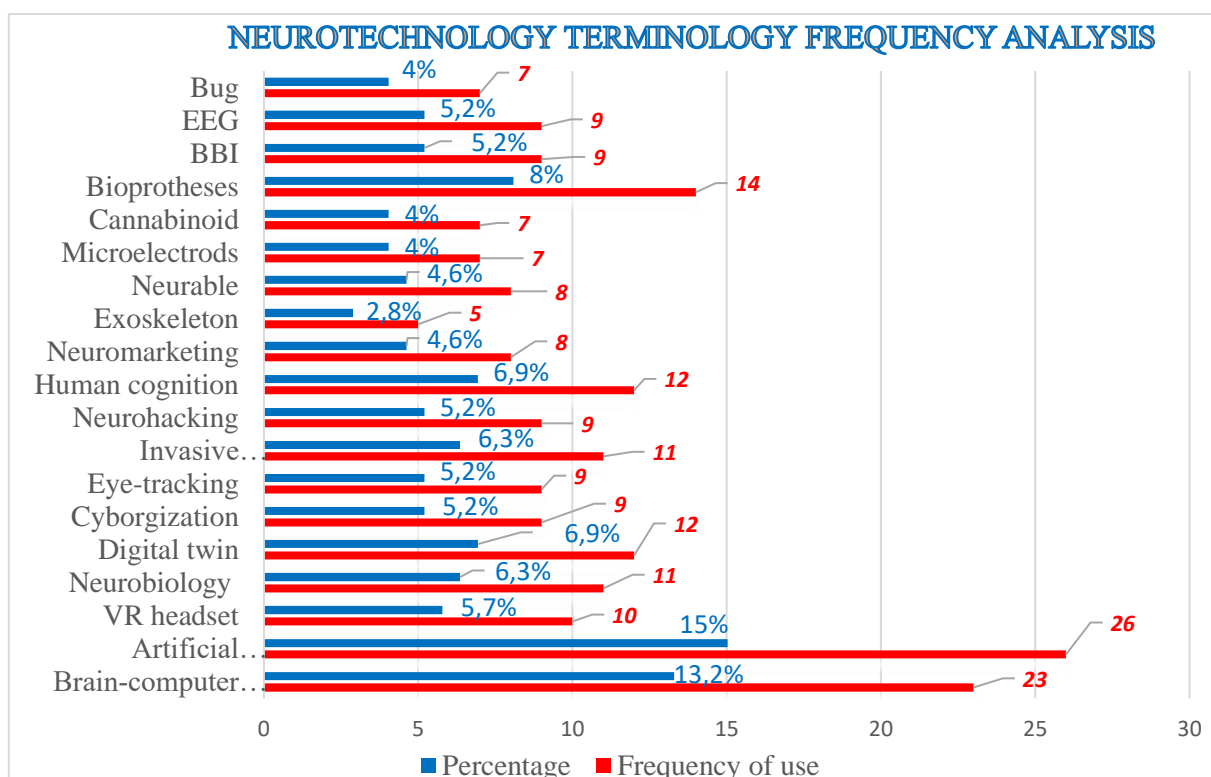Figure 1 illustrates the frequency of terms in neurotechnology.



Figure 1 – Analysis of neurotechnology terminology usage

From these results, several conclusions can be drawn regarding the popularity and relevance of certain concepts in the field of neurotechnology.

High-requency terms (occurring 10 times or more) are particularly relevant and actively discussed in neurotechnology podcasts. Terms such as *"AI"* (26 occurrences-15%), "*the brain-computer interface"* (23 occurrences-13,2%) play a key role and are considered leading directions in the field, facilitating the direct transfer of commands from the brain to a device.

Artificial bioprostheses (14 occurrences-8%) are highly relevant in medical context, specifically for restoring lost limb functions. For example, in one podcast, Elon Musk's bioprosthetic projects through his company Neuralink were discussed, illustrating the practical application of these technologies.

The terms *"digital twin"* and *"human cognition"* (12 occurrences-12%) are actively discussed because as they are at the forefront of scientific research and are being integrated into modern technologies. These terms signify a shift towards the integration of digital models and a deeper understanding of human cognitive processes in neurotechnological innovations.

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Terms such as *"cyborgization", "eye-tracking", "BBI"* (brain-to-brain interface), and *"EEG"* (electroencephalography) (9 occurrences-5,2%) are actively studied and may become more popular in the coming years. However, while EEG has been in use for a long time, its frequency of discussion has decreased in recent years as more advanced technologies have emerged.

Low-frequency terms suggest that some technologies are still under development or are only occasionally discussed in podcasts, indicating that they may not yet be widespread in public or scientific discourse. Table 4 demonstrates category of neurotechnology terminology.

Table 4 – Category of neurotechnology terminology

| № | Category | Number of terms | Percentage | Examples |
|---|----------|-----------------|------------|----------|
| 1 | Borrowing | 47 | 27,1% | Neuroplasticity, neurofeedback, neural stimulation, neuroinformatics et.c. |
| 2 | Abbreviation | 35 | 20,2% | BCI (Brain-Computer Interface) EEG (Electroencephalography) fMRI (Functional Magnetic Resonance Imaging) TMS (Transcranial Magnetic Stimulation) |
| 3 | Calque | 29 | 16,7% | Brain mapping, cognitive load, mental workload, brain-to-computer communication, virtual embodiment |
| 4 | Neologism | 29 | 16,7% | Neuroprosthesis, neuromodulation, neurocybernetics, mind uploading, cognitive augmentation |
| 5 | Blending | 26 | 15% | Neurochip (Neuro+Chip) Neurodynamics (Neuro+Dynamics) Cyborgization (Cyborg+ization) Neurofusion (Neuro + Fusion) |
| 6 | Hypernymy | 2 | 2,3% | Device - neurodevice |
| 7 | Hyponymy | 2 | 2,3% | Brain-computer interface |
| 8 | Loanwords | 2 | 1,1% | Computer virus, neural network |
| 9 | Backformation | 1 | 0,5% | Rewire from rewiring |
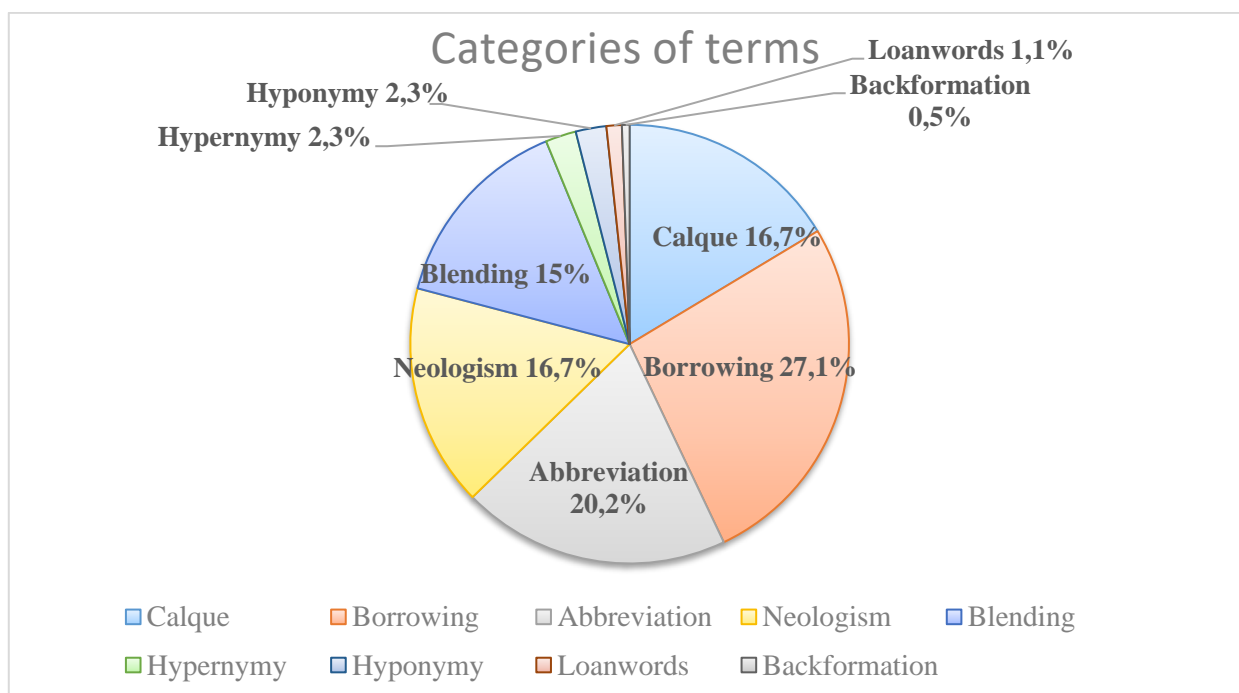


Diagram 1 – Categories of neurotechnology terminology

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As shown in diagram 1, borrowings (47 terms, 27,1%) dominate among other categories, indicating that neurotechnology terminology is often borrowed from other fields as we mentioned above. (e.g., *Neuroplasticity, neurofeedback, neural stimulation, neuroinformatics human cognition* et.c). Most of these terms are related to international scientific and technological trends.

As the second most frequent category, abbreviations (35 terms, 20,2%) are widely used in scientific and technical disciplines to improve efficiency and clarity. For instance, terms such as BCI (Brain-Computer Interface) and EEG (Electroencephalography) are commonly employed in neurotechnology research and applications.

As to calques and neologisms (29 terms, 16.7%) both two categories account for an equal share of the analyzed terminology. Calques arise from direct translations of terms from other languages, such as *"brain mapping"*, which reflects similar conceptual structures across different linguistic systems.

Hypernymy, hyponymy and loanwords (2 terms, 2,3%), backformation (1 term, 0,5%) occur less frequently compared to other categories.

Figure 2 demonstrates the key terms actively used in podcasts

Figure 2 – Actively used terms in podcasts

## DISCUSSION
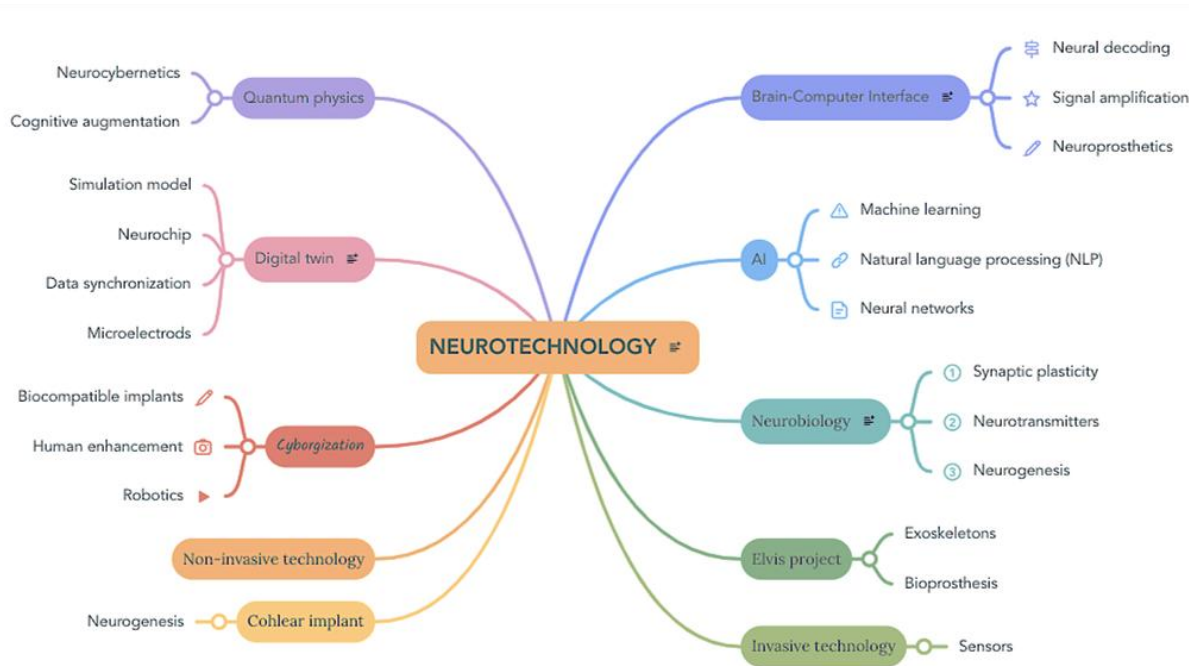


The results of this study show that neurotechnology terminology was conveyed by podcast authors in an accessible manner through the use of explanations, dialogical techniques, and a user-friendly approach.

Based on the podcast analysis, a comparative study of two formats was conducted: the podcast-interview and the podcast-monologue.

Table 4 Comparative analysis of podcast formats

| № | Aspects | Interview-based podcast | Monologue-based podcast |
|---|---------|-------------------------|-------------------------|
| 1 | **Speech style** | More formal language used by the authors. Based on a question-and-answer structure | Tends to use informal and conversational speech |

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ISSN 2788-7979 (online)

| 2 | **Explanation of terms** | Authors explain complex terminology with example from their experiences | Authors use colloquial clichés and don't always exoain or simplify terms |
|---|---|---|---|
| 3 | **Translation of foreign terms** | Authors provide translations of foreign terms | Authors may not always translate foreign terms and may use slang and borrowings in their speech |
| 4 | **Examples** | Authors provide examples based on their own experience | Authors may not provide examples or may use general explanations without personal context |

In the comparison between interview-based and monologue-based podcasts, we observe distinct differences in the style of speech, explanation of terms, translation of foreign terms, and the use of life examples.

Interview-based podcasts typically use more formal language, with authors explaining complex terminology and offering translations of foreign terms. For example, author A. Grinbaum, while using English terms in his speech, also provides their translations into Russian.  (*"Brain-computer interface"*, in Russian "нейровычислительные программы или интерфейс между машиной и мозгом" или данные из мозга то, что называется *"brain-data")*.

They clarify the difference between "invasive technology" and "neurotechnologies". "Neurotechnology" is defined as a device, such as a helmet, that provides visual signals to the eyes. Consequently, a helmet equipped with electrodes, sensors and detectors that collect data from the surface of the brain is categorized as "invasive technology". "*The Elvis Project*" describes by authors as a device for blind people to perceive an image of their surroundings.

The question-and-answer structure helps the audience understand complex terms. Such phrases as *"As far as I concerned, I think I understand, I see, I see, I understand now", and "from my perspective"* reflect their attentiveness and facilitate the audience's comprehension of complex concepts. This approach contributes to making the discussion more accessible and engaging for listeners.

 Authors also provide practical examples from their own experiences. For instance, A. Huberman explaining *"Psilocybin"* effect confirmed "I have never been in a ketogenic state. You can increase ketone levels in your blood, improving cognitive abilities" .

On the other hand, monologue-based podcasts tend to adopt a more informal and conversational tone to popularize their podcasts. For example: *Устраивайтесь поудобнее, я расскажу вам так, чтобы понял даже шестилетний гуманитарий. Поехали! Приготовьтесь услышать страшную правду.* Such phrases create a closer atmosphere with the audience, softens sophisticated topics and reduces the barrier between the expert and the audience.

The authors may not always explain or translate foreign terms, and they may rely on slang, loanwords, or borrowings. *Я прямо вангую* - вангую means "to predict." *Олдовые телефоны* means "old phones". *Раскабаневшая модель чат GPT* means "updated version of GPT."

These podcasts may not provide personal life examples, and instead, explanations are often generalized or less detailed.

These differences suggest that interview-based podcasts are more structured and informative, while monologue-based podcasts tend to be more relaxed and less focused on detailed explanations.

LIMITATIONS. The limitations of this study include the exclusion of analysis on articulation, intonation, and speech tempo, which could have provided additional insights into the communication of terminology. The sample size of 15 podcasts may not fully represent the variety of neurotechnology-related terms across all media formats. Additionally, some rare or emerging terms might not have been captured in the analysis. The study focused on a specific podcast format, as interview-based and monologue-based podcasts.

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ISSN 2788-7979 (online)

Bulletin of S.Ualikhanov KU.
Philological Series. № 1, 2025

## CONCLUSION

This study analyzed 15 neurotechnology podcast episodes, totaling 12 hours of content. Lexical and semantic analysis identified 173 terms, categorized as follows: borrowings, neologisms, calques, blendings, abbreviations, jargon, loanwords et.c.

Borrowed terms account for 27.1% of all terms, indicating the strong influence of the English language on neurotechnology terminology. Abbreviations comprise 20.2%, reflecting the highly specialized field.

Terms such as "brain-computer interface," "bioprotheses," and "cyborgization" are actively discussed and are central to scientific discourse. Additionally, the presence of terms like "cannabinoid" and "exoskeleton" highlights the interdisciplinary field of neurotechnology, as it integrates concepts from robotics, medicine, and other domains.

Podcasts prove to be an effective tool for popularizing neurotechnology, as they make complex scientific terms more accessible to a broader audience. However, this process does not always ensure complete accessibility for all listeners.

Our hypothesis is partially confirmed, as not all podcasts adopt strategies to simplify terminology. Some maintain a high level of complexity, making them difficult to understand for listeners without specialized knowledge. While expert interviews contribute to a more thorough explanation and translation of terms, monologue-based podcasts often rely on less detailed explanations and may target a wider audience, which does not always facilitate full comprehension of the topic.

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**Подкасттардағы нейротехнологиялық терминологияларды лексикалық-семантикалық талдау**

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*Бұл мақала "YouTube", "www.litres.ru" және "Podcasts.lab" сияқты танымал платформаларда подкасттардың заманауи медиа-коммуникация жанры ретінде нейротехнология терминологиясының қалыптасуына, бейімделуіне және танымал болуына қалай ықпал ететінін зерттейді.*

*Жаһандану және технологияның қарқынды дамуы дәуірінде жаңа ғылыми терминдердің пайда болуы олардың күнделікті тілге тиімді интеграциялануын талап етеді. Подкасттар күрделі терминдерді қарапайым және тартымды түрде түсіндіруге мүмкіндік беретін маңызды құрал болып табылады.*

*Зерттеудің мақсаты — подкасттардағы нейротехнология терминологиясының лексикалық және семантикалық ерекшеліктерін талдау, арнайы лексиканы бейімдеу стратегияларын анықтау және ғылыми білімді насихаттауда әртүрлі подкаст форматтарының тиімділігін салыстыру.*

*Зерттеудің ғылыми жаңалығы подкасттарды нейротехнология терминологиясын қалыптастыруға және таратуға ықпал ететін медиадискурс жанры ретінде қарастыруында жатыр. Бұл тақырып бұған дейін лингвистикалық тұрғыдан зерттелмеген.*

*Зерттеу мақсатына жету үшін сандық және сапалық әдістер, соның ішінде лексика-семантикалық талдау, контент-талдау және салыстырмалы талдау қолданылды.*

*Подкасттар танымалдығы, тақырыптың өзектілігі және форматы (бұл зерттеуде монолог-подкаст және сұхбат-подкаст) сияқты критерийлер негізінде таңдалды.*

*Аудио және бейнематериалдар "Taguette", "Python" бағдарламаларының көмегімен транскрипцияланды, ал кодтау процессі "QualCoder" бағдарламасы арқылы жүзеге асырылды. Терминологиялық бірліктер олардың лексикалық және семантикалық сипаттамаларына қарай жіктелді (мысалы, кірме сөздер, неологизмдер, қос сөздер, калькалар, аббревиатуралар және т.б.).*

*Контент-талдау терминдердің жиілігін, олардың түсіндірмелерін және нақты мысалдардың қолданылуын анықтауға мүмкіндік берді. Соңғы кезеңде подкаст форматтары салыстырылды. Нәтижелерді визуализациялау үшін "Miro" бағдарламасы пайдаланылды.*

*Осы зерттеудің нәтижелері лексикография саласындағы мамандар үшін құнды ресурс бола алады және арнайы білім алуға немесе осы салада жаңа ақпарат игеруге қызығушылық танытатын кең аудиторияға пайдалы болуы мүмкін.*

*Кілт сөздер: нейротехнология, подкаст, киборгизация, цифрландыру, ми-компьютер интерфейсі, нанотехнология.*

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**Лексико-семантический анализ нейротехнологических терминологий в подкастах**

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*Эта статья исследует как подкасты, как современный жанр медиакоммуникации, способствуют формированию, адаптации и популяризации терминологии в области нейротехнологий на популярных платформах, таких как "YouTube", "www.litres.ru" и "Podcasts.lab", среди широкой аудитории.*

*В эпоху глобализации и стремительного развития технологий появление новых научных терминов требует их эффективной интеграции в повседневный язык. Подкасты предоставляют ценный инструмент для понимания сложных терминов непрофессионалами в доступной и увлекательной форме.*

*Цель данного исследования – проанализировать лексико-семантические особенности терминологии нейротехнологий в подкастах, выявить стратегии адаптации специализированной лексики и сравнить эффективность различных форматов подкастов в популяризации научных знаний.*

*Научная новизна работы заключается в рассмотрении подкастов как жанра медиадискурса, способствующего формированию и распространению терминологии нейротехнологий – темы, ранее не изученной с лингвистической точки зрения.*

*Для достижения исследовательской цели были использованы количественные и качественные методы, включая лексико-семантический анализ, контент-анализ и сравнительный анализ.*

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Bulletin of S.Ualikhanov KU.
Philological Series. № 1, 2025

Выбор подкастов основывался на таких критериях, как популярность, актуальность темы и формат (в данном исследовании рассматриваются подкасты-монологи и подкасты-интервью).

Аудио- и видеоматериалы были транскрибированы с использованием программ "Taguette" и "Python", а процесс кодирования проводился с помощью "QualCoder". Терминологические единицы классифицировались в соответствии с их лексико-семантическими характеристиками (например, заимствования, неологизмы, контаминации, кальки, аббревиации и др.).

Контент-анализ позволил выявить частотность терминов, их объяснения и использование реальных примеров. На заключительном этапе проведено сравнение форматов подкастов. Для визуализации результатов использовалась программа "Miro".

Результаты данного исследования могут послужить ценным ресурсом для специалистов в области лексикографии, а также быть полезными для широкой аудитории, заинтересованной в специализированном обучении или получении знаний в данной области.

Ключевые слова: нейротехнологии, подкасты, киборгизация, цифровизация, интерфейс «мозг-компьютер», нанотехнологии.

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