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RESEARCH ON THE THEORETICAL BASIS AND EXPERIMENTAL PATHWAY OF MUSIC THERAPY BASED ON ARTIFICIAL INTELLIGENCE TECHNOLOGY

Abstract*: this study aims to explore the theoretical underpinnings and experimental frameworks of music therapy, particularly when augmented by artificial intelligence (AI) technology. The increasing integration of AI in various scientific domains and daily life prompts its consideration in medical and musical applications. The primary objective is to assess the efficacy of AI-generated music in music therapy settings. To achieve this, a multi-faceted approach combining synthesis, analysis, induction, deduction, and descriptive methods is employed. Additionally, the historical-genetic method is utilized to trace the genesis and evolution of the music therapy-AI intersection. The practical implications of this research are profound, as the findings can inform the development of music therapy practices that incorporate AI. Initial findings suggest that AI enables a more individualized approach in music therapy, which is advantageous. Furthermore, AI-assisted melody creation for therapeutic purposes is significantly faster than traditional methods relying solely on human composition. Consequently, this study underscores the novelty and significance of AI in music therapy research.*

Keywords*: artificial intelligence, music therapy, theoretical basis, experimental pathway.*

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ИССЛЕДОВАНИЕ ТЕОРЕТИЧЕСКИХ ОСНОВ И ЭКСПЕРИМЕНТАЛЬНОГО ПУТИ МУЗЫКАЛЬНОЙ ТЕРАПИИ, ОСНОВАННОЙ НА ТЕХНОЛОГИИ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

Аннотация*: исследование направлено на изучение теоретических основ и экспериментальных разработок музыкальной терапии, особенно в сочетании с технологией искусственного интеллекта (ИИ). Растущая интеграция ИИ в различные научные области и повседневную жизнь побуждает к его использованию в медицине и музыке. Основная цель – оценить эффективность музыки, генерируемой искусственным интеллектом, в условиях музыкальной терапии. Для достижения этой цели используется многогранный подход, сочетающий синтез, анализ, индукцию, дедукцию и описательные методы. Кроме того, историко-генетический метод используется для того, чтобы проследить генезис и эволюцию взаимосвязи музыкальной терапии и искусственного интеллекта. Практическое значение этого исследования весьма велико, поскольку полученные результаты могут послужить основой для разработки методов музыкальной терапии, использующих искусственный интеллект. Первоначальные результаты показывают, что ИИ обеспечивает более индивидуальный подход в музыкальной терапии, что является преимуществом. Кроме того, создание мелодий с помощью ИИ в терапевтических целях происходит значительно быстрее, чем при использовании традиционных методов, основанных исключительно на человеческой композиции. Следовательно, это исследование подчеркивает новизну и значимость искусственного интеллекта в исследованиях музыкальной терапии.*

Ключевые слова*: искусственный интеллект, музыкальная терапия, теоретические основы, экспериментальный путь.*

1. Introduction.

Music therapy has been recognized as an effective intervention for individuals with a variety of mental and physical health conditions. With the advent of artificial intelligence (AI), novel approaches have been developed that use AI algorithms to personalize and optimize traditional therapies. This paper focuses on exploring how AI can be integrated into music therapy to further improve its effectiveness and efficiency.

The relevance of the topic lies in the fact that many areas of science and life are now being created using a variety of technologies. This may include artificial intelligence. With the help of artificial intelligence, a person will be able to give work to machines, and in his spare time do the things he wants to do. Thus, humanity will learn to save time and distribute it correctly, while machines will do actual work for it, including writing music. This is how the most optimistic theories sound. However, there is a problem – can an inanimate device create beautiful music like a human? Is it worth putting art in the hands of robots at all? This problem is debatable, and therefore research on the topic is relevant.

It is necessary to determine the state of scientific knowledge on this topic. It is noticeable that scientists often turn to the topic of using AI in their works. As already mentioned, this problem is very relevant for the technological XXI century. As the scientist Palmov says, AI is often used in music services [9, 198–203]. In our country, this scientific problem is also occupied by art critic Larisa Nagornaya, who believes that creating music with the help of artificial intelligence is a very progressive field of research. However, she believes that in this area, the creative principle of the person himself should be in the first place [7, 32–43].

This point of view is shared by Olga Peredelkina, an expert at the Higher School of Economics, one of the best universities in Russia. She also believes that artificial intelligence can only serve as a help for humanity in art, but it cannot in any way become a substitute for traditional creativity [10].

Articles are also published in Scopus publications. For example, we can recall an article by Yulia Ovchinnikova, which is called «Anthropological foundations of music-oriented health-saving technologies» [8, 46–64]. It is important that the topic is

connected with the stated topic of our article – the influence of music created with the help of artificial intelligence on human health and on his rest. The author believes that such music has a great effect on human health – both mental and physical.

Interestingly, many scientists believe that one of the main functions of AI can be communication [4], but AI requires detailed legislation in its use [2].

It is important to understand that these are also ethical issues, because the use of AI can lead not only to unemployment, but also to the fact that people will stop writing music themselves [12, 57–73]. However, AI can help solve faster those tasks that people would spend whole months solving [5, 11–20].

Thus, the key problem of all research on the relationship between music and artificial intelligence concerns the question – can a machine write the same beautiful music as humans? The purpose of writing any piece of music is a person's rest and relaxation. Is it possible to achieve this goal with the help of machines?

Thus, after reviewing the literature, it is noticeable that there are «white spots» in the topic, that is, something that is poorly touched upon in the works of other scientists. This concerns first of all the advantages of using AI in music therapy, and therefore the article will be devoted specifically to this issue.

2. Methodology.

This paper adopts a mixed-methods approach that includes a literature review and analysis of existing studies. The review focuses on research articles that investigate the use of AI in music therapy interventions, identify successful implementation strategies, and assess the impact of these interventions on patient outcomes. Following the literature review, a framework is proposed that integrating AI and music therapy, thereby providing a roadmap for future research and practice.

Of course, the article will use traditional scientific research methods. For example, synthesis, analysis, deduction and induction, classification and description. However, a special scientific method will also be used, which is called the historical-genetic method (it is often used even by professional historians), the essence of which is to consistently track the causes of the origin of some phenomenon or process, and then – in a consistent description of it, in order to eventually come to a conclusion.

The aim of the study is to characterize the effectiveness of the inclusion of music created with the help of artificial intelligence in music therapy. To achieve this goal, it is necessary to set and achieve a number of tasks. For example:

1) to trace the process of the formation of music therapy;

2) to trace the process of the emergence of music created with the help of artificial intelligence;

3) to substantiate the significance of the inclusion of this music in music therapy.

3. Results.

It is obvious that initially people could not create music and lyrics using machines, since they had not yet been invented. However, music in all times and epochs has been an important resource for a person – in terms of escapism, recreation and even learning. Scientists have proved that listening to music has a healing effect on a person and on his consciousness. We noticed this feature back in Antiquity. However, in the future, music therapy developed more actively, it is used especially effectively today. Brian Harris is a specialist in a relatively new field: neurological music therapy (NMT). It is a growing therapeutic research unit that uses melodies to train the brain in parallel with physical exercise. When Harris was a clinical physician at a rehabilitation hospital in Boston, he worked with many people who suffered from stroke and other brain damage. This made it impossible for them to walk. However, the NMT rate improved the situation at times. After it was completed, patients and their families often asked the doctor if it was possible to continue with NMT after discharge? But the procedure was prescribed only to hospital patients, and it was impossible to simply sign up and go through it. Brian Harris founded a special company MedRhythm, where he provides music therapy services to patients. As Mr. Harris himself says: «There is no other equally effective impulse in nature that engages the human brain in work on the same scale as music." The principle of its operation is that patients with diseases (for example, Parkinson's disease) listen to music while walking, which makes people more willing to move, which leads to a speedy recovery [13].

In fact, the stages of creating an AI melody are quite complex [1], and therefore sometimes their use can be too expensive for ordinary people [15].

The XX century was marked by an unprecedented surge of discoveries in the field of science and technology: a man's spacewalk, the invention of high-tech ways of communication. Inevitably, new approaches to the awareness of space and time in the musical art are emerging. A new milestone in art is the appearance of electronic, electroacoustic music.

Edison Denisov's famous piece «Birdsong» for magnetic tape and prepared piano (1969) was created in the Moscow Experimental Electronic Music Studio at the A. Scriabin Museum.

It is interesting that in the 1960s the museum was headed by E. Murzin, a Soviet military engineer, inventor of one of the world's first photooptic polyphonic synthesizers, named «ANS» in honor of A. Scriabin, the great Russian composer.

Denisov's «Birdsong» includes an electronic soundtrack and a graphic score sheet for the solo artist. The basis of the play consists of recordings of birds singing, forest sounds and various electronic sounds. The soloist's part is recorded graphically in the score, in the form of concentric rings belonging to certain segments of the magnetic film; these symbols correspond to various ways of sound attraction on piano strings and keys [7, 32–43].

In the XXI century, a separate niche is beginning to be occupied by works created through artificial intelligence, where human-designed machines (computer programs) themselves act as creators. Artificial Intelligence Virtual Artist (AIVA) is an artificial intelligence, a «virtual composer» created by American composer David Cope; the invention was officially patented and recognized by the music professional association. AIVA («Virtual Composer») specializes in composing musical works in the «classical style» and soundtracks for movies [7, 40].

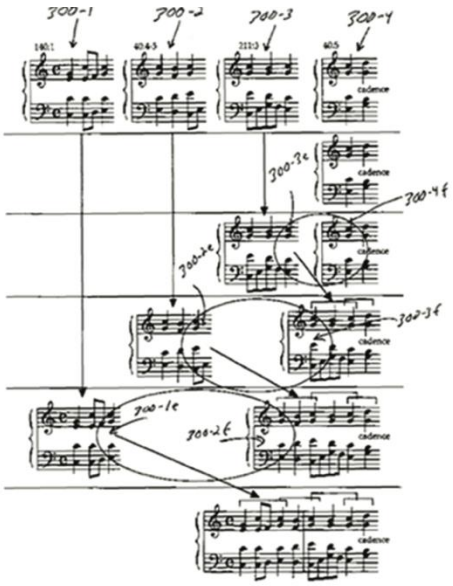

Fig. 1. Fragment of the AIVA patent. A source: Nagornaya L. Scientific achievements and artificial intelligence in the world of musical art (2020) J Culture and Education: scientific and informational journal of universities of Culture and Arts. 10: 40

In this context, works written in such techniques of musical composition of the XX century as dodecaphony, serialism, aleatorics and others appear in an unexpected perspective and can be reinterpreted as a kind of artistic metaphors – harbingers of works of art created later through artificial intelligence; a kind of «game» of artists in artificial intelligence.

It can be concluded that in the modern digital era, the synthesis of science and art has quite taken place. However, one of the main questions facing humanity is how to counter the increasing threats of digital civilization, since the creative principle that has spiritualized and united science and art since Antiquity should not be completely replaced by impersonal soulless technology in the future.

The main advantage of the process of creating musical compositions with the help of artificial intelligence is that it is much faster to create the right melody that this patient personally likes. A doctor with the help of music therapy can quite actively change the treatment process, because technology allows you to create music faster and more suitable for specific situations [7, 32–43].

In the field of music generation, the «Turing music test» is sometimes used. For example, the DeepBach algorithm was tested, which generates notes in the Bach style. More than 1.2 thousand people (both experts and ordinary people) were interviewed, who had to distinguish the real Bach from the artificial one. And it turned out that it was very difficult to do this – people can hardly distinguish between chorales composed by Bach and those created by DeepBach.

It seems that a person should regulate the process of artificial intelligence and continue, including independent work in terms of creativity, so as not to completely transfer art to machines. It is important to find a balance between the convenience of AI in creating creative works and a person's own efforts, because, as you know, any creativity helps consciousness develop.

AI can also be involved in the process of creating music in the spirit of medical music therapy, since the articles listed in the list of sources indicate specific research and experience of scientists in this field (for example, the example of the scientist mentioned above, B. Harris [13]). I must say that with the help of AI, you can create music that will be aimed at the treatment of psychiatric diseases, deviant behavior of adolescents.

The advantage of using AI in music therapy, of course, is the fact that the machine does not make mistakes, unlike a human, but works in a clearly defined program (for example, classical music). Just as a piece of music succeeds in variations, the diversity of the training dataset is of paramount importance. The diverse data set includes music of different genres, languages and cultures. This diversity helps ensure that the machine learning model is versatile and reliable, capable of handling a wide range of types of music, not just those on which it was primarily trained.

The literature review identified several areas where AI has shown promise in enhancing music therapy interventions. These include personalizing treatment based on patients' preferences and needs, monitoring treatment progress in real-time, and analyzing patients' responses to music therapy interventions. The proposed framework highlights the importance of data science, machine learning algorithms, natural language processing, and human-computer interaction in developing innovative music

therapy interventions. The framework also recommends key steps for successful implementation, including training therapists on AI technology, addressing ethical and privacy concerns, and evaluating treatment outcomes.

4. Discussions.

A major discussion about AI concerns the ethical foundations of their use in art. Researchers have different points of view on this issue. For example, art historian Gorbacheva A. [3, 145–154] believes that AI is quite capable of helping a person even in art. A similar point of view is shared by E. Morkovkin [6, 55–59], who believes that AI will soon become an important part of people's lives.

However, not everyone thinks so Shwars I. believes that AI cannot create like a human [14]. The discussion is just continuing.

Russian scientists are also developing opportunities in terms of innovations in music therapy. For example, in 2019, a whole collection dedicated to these issues was published in Moscow. In general, scientific music therapy today is a direction that uses more than 50 different musical and acoustic methods and technologies for the correction of mental and physical health, disease prevention, social rehabilitation and creative development of the individual [11]. This collection concludes that the use of AI in music therapy is not only useful, but also important for the future. Thus, the situation was similar to the one we came to after our research.

5. Conclusion.

This paper demonstrates how integrating artificial intelligence into music therapy can lead to more effective and efficient interventions for diverse populations. The proposed framework provides a foundation for future research that explores the potential of AI in enhancing music therapy practices. It also highlights the importance of addressing ethical and privacy concerns to ensure the responsible use of AI in the field of music therapy. Finally, the paper recommends key steps for practitioners and researchers to consider when implementing AI-powered music therapy interventions.

The main one is to find a balance between the work of AI and human. In general, AI in the conditions of technological age developments can and should work, including in terms of music therapy, which makes it easier, since AI allows you to create melo-

dies faster and easier, as well as taking into account the individual characteristics of a person (or his problems and diseases).

Thus, as a result of the study, it is permissible to highlight the following theses:

1) AI helps to find an individual approach to each patient of music therapy, which increases the chances of effective treatment;

2) AI generates the necessary materials faster than a person, and therefore the treatment process becomes easier and simpler;

3) it is concluded that AI can be a good assistant in music therapy.

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