

Research on the Audience's Ability to Identify AI-Generated Pop Music

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How to cite this paper: Chen, Y. L. (2026). Research on the audience's ability to identify AI-generated pop music. *Art Horizons*, 2(2), 47–56. ISSN Print: 3079-5176; ISSN Online: 3079-5184.
<https://doi.org/10.63313/ah.9035>

Published: 2026-01-30

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Abstract

With the rapid development of generative artificial intelligence in the field of artistic creation, AI composition technology has been widely applied. The music it creates is increasingly similar to human works, making it difficult for listeners to distinguish AI-created popular music. This study aims to deeply explore the audience's ability to recognize AI-created popular music, the factors influencing recognition, and the impact of the characteristics of AI-created music on recognition. The research adopted the questionnaire survey method. Through the data analysis of the returned questionnaires, it provided references for music creation, the music industry, and the improvement of AI's independent creation capabilities.

Keywords

Pop music; AI composition; artificial intelligence recognition; Music perception; human-machine collaboration

1. Introduction

1.1. Research Background

Currently, generative artificial intelligence is developing rapidly in the field of artistic creation, and various AI creation systems are constantly emerging and widely applied in multiple artistic fields. Among them, AI composition has changed the mode of music creation and consumption, and the music created by AI presents a "pseudo-subjectivity" in terms of thinking and connotation, becoming increasingly similar to the music created by humans. In this context, it is difficult for listeners to determine the authenticity of AI-created popular music, and this phenomenon urgently requires research. [1]

1.2. Research Objectives

This study focuses on the recognition ability of listeners towards AI-created popular music. Specifically, it aims to understand the recognition capabilities of different listener groups, analyze the factors influencing recognition, and explore the impact of the characteristics of AI-created popular music on recognition; ultimately

providing references for music creation, the music industry, and the autonomous creative ability of generative artificial intelligence. [2]

1.3. Research Significance

Studying how listeners recognize AI-created popular music can reveal the internal mechanisms of human perception of musical styles and emotional expression, as well as how these mechanisms manifest when faced with AI-created music, thereby promoting the development of music perception and cognition theories. [3]

Clarifying the recognition ability of listeners towards AI-created popular music can help identify technical deficiencies, improve algorithms, optimize emotional expression and style generation mechanisms, and enhance the quality of AI music, making it closer to excellent human works.

Understanding listeners' views on AI-created music can help human creators draw on the advantages of AI and avoid its limitations, achieving complementary advantages and creating higher-quality works.

Providing solutions for ethical and legal issues such as copyright ownership and the definition of the creative subject of AI music, promoting the establishment of relevant systems, protecting the rights and interests of all parties, and promoting the healthy development of the industry.

2. Literature Review

Zi Jian explored the application of AI in composition and composition theory, and his research shows that in the creative field, AI has advantages such as speed, efficiency, creative inspiration, and personalized customization, which may affect listeners' perception and recognition of AI-created popular music (Wang Zijian, 2024).[12] For example, the efficiency of AI creation enables it to quickly produce a large number of works, enriching the music market and changing the scope of music exposure for listeners, which may affect their recognition ability of AI-created music; while the creative inspiration and personalized customization features of AI make the music styles diverse and tailored to audience preferences, which may increase the difficulty of recognition for listeners, or make certain works more easily identifiable due to their unique styles. [6]

Qin Yue reviewed the development history of artificial intelligence composition, analyzing its "pseudo-subjectivity" feature, and pointed out that AI composition has already shown "pseudo-subjectivity" in creative thinking and musical connotation, capable of simulating human creative thinking, and demonstrating certain manifestations in emotional expression and creative expression (Qin Yue, 2023). [7] This means that AI-created popular music to some extent possesses the characteristics of human music, and listeners' recognition may be influenced by these "pseudo-subjectivity" features, such as emotional calculation enabling AI-created music to express human-acceptable emotions, which may interfere with their judgment of whether it is AI-created. [8]

Jiang Fang reported the "Digital Muse - 2024 Music Technology Fusion Festival" where AI and human composers competed in creation, showcasing the achievements of the integration of music and technology, reflecting the practice of AI in the field of music creation. The display of these practical achievements has influenced public perception of AI-created music, which may have an impact on listeners' recognition of AI-created popular music (Jiang Fang, 2024).[4] For example, through such activities, listeners' familiarity with AI-created music increases, which may improve their recognition ability; however, the blurring of the boundaries between AI and human creation may also increase the difficulty of recognition. Su Jiawei took the Keras deep learning framework as an example to conduct practical and theoretical research on AI composition, verifying the feasibility of AI composition and analyzing its artistic and practicality in creation (Su Jiawei, 2021).[10] This provided a technical practice-based basis for understanding the characteristics of AI-generated music creation, and was helpful in exploring the issue of listeners' ability to recognize AI-created popular music. For instance, the style characteristics formed during the technical implementation of AI composition, such as the logic of generating music and the imitation of specific styles, would affect the listeners' identification and judgment. The advantages and limitations of the technology might be reflected in the listeners' identification experience. [9]

The four papers provided rich research foundations for "Exploring the Identification Degree of Audiences for AI-Composed Popular Music". In the development of AI composition, it was clarified that it continuously evolves under the promotion of technology and is increasingly widely applied. This is an important background for studying the identification degree of audiences.[11] The technical principles and creative characteristics of AI composition, such as based on algorithm models, simulating human creative thinking, expressing emotions and creative expression, directly relate to the perception and judgment of the audience towards the works and are the key factors affecting the identification degree. The practical activities of integrating music and technology have changed the mode of music creation and dissemination, and are also changing the music experience and cognition of audiences, indirectly influencing the identification degree of audiences for AI-composed popular music. Future research can be based on these foundations, through empirical research and other methods, to deeply explore the identification degree of audiences for AI-composed popular music and its influencing factors, and further clarify the development direction of AI in the music field and its impact on the music industry.[13]

3. Research Methods

This study presented two songs - one created by AI and the other non-AI - both with the same style, chord progressions, and musical structure, to the audience for identification. A questionnaire was developed, covering aspects such as the

audience's understanding of AI-generated music, their identification experiences, the basis for identification, and judgments on influencing factors.

3.1. Music Production and Questionnaire Design

To ensure the data is accurate, the music production process set up a comparison for the two songs. Apart from the different melodies, both songs were classified as pure music of the pop genre (Pop), using the same C major scale and chord progressions of C, F, Dm, and C. In terms of musical structure, they both followed the pattern of prelude (Intro), verse (Verse), chorus (Chorus), and outro (Outro), with a constant tempo of 98 BPM. In terms of instrument selection, both songs used guitar, bass, MIDI piano, drums, and string section. The AI-generated song was created using the SOUNDRAW software (Figure 1). This software uses advanced algorithms and a large amount of music data for training to simulate human creative thinking. Given the chord progressions, musical structure, and instrument configuration, it generates melodies, harmonies, and rhythm combinations that conform to the pop music style. The non-AI-generated song was produced using the KUBA software (Figure 2), which includes a professional song-making system and various instruments and sound options. The creator manually arranged the combinations of each instrument on the tracks, integrating an understanding and expression of pop music, strictly defining each section, and making the music full of human emotions. The different production methods of the two songs provided a comparative sample for studying the audience's recognition.

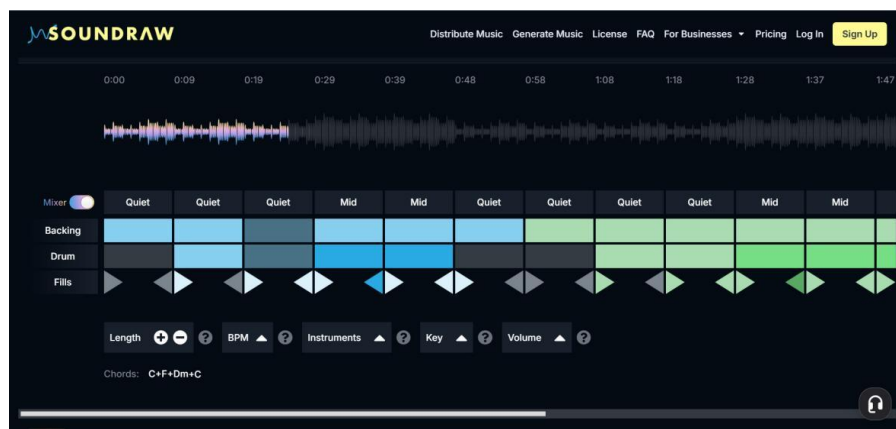


Figure 1. SOUNDRAW

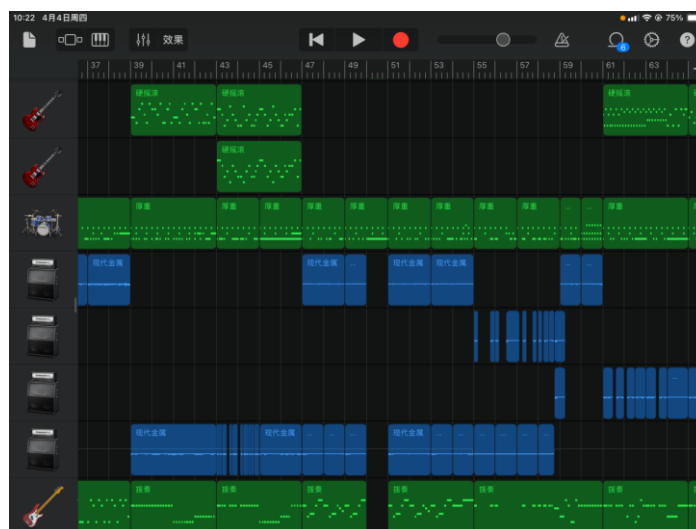


Figure 2. GarageBand

The questionnaire design aims to deeply explore the audience's understanding, experience, and judgment basis regarding AI-generated music. In terms of the level of understanding, questions such as "Have you ever learned about or come into contact with AI-generated music?" and "Which channels do you usually use to access AI-generated music?" were set to assess the audience's awareness and access methods of AI-generated music. Regarding the recognition experience, the question "Have you ever attempted to identify AI-generated popular music? How was the result?" was asked to understand the actual experience of the audience in this regard. Regarding the basis for recognition, questions such as "Which aspects (such as melody, rhythm, lyrics, etc.) do you mainly rely on when identifying AI-generated popular music?" were asked to help analyze the considerations of the audience during recognition. Additionally, questions such as "Which factors do you think would affect your identification of AI-generated popular music?" were asked to explore various factors that influence the audience's identification.

In terms of the selection of questionnaire samples, different groups of people were considered. The audience was divided according to their preferences for music styles, covering popular, rock, classical, folk, etc., to explore the impact of different music preferences on recognition. At the same time, there was a distinction between music listeners with a background in music knowledge and those with no prior musical knowledge, including those who have received professional music education, have musical instrument performance experience, or have deeply studied music theory. This sample selection can collect data from multiple dimensions and comprehensively analyze the differences in recognition of AI-generated popular music among different types of audience, providing a more in-depth and broad basis for research.

3.2. Questionnaire Distribution and Data Collection

The questionnaire distribution channels included online social media platforms (WeChat, QQ, Xiaohongshu, Douyin, Bilibili, etc.), mainstream music apps (NetEase Cloud Music, QQ Music, Apple Music, etc.), as well as paper-based questionnaires distributed at music festivals (Strawberry Music Festival), concerts (Coldplay Hong Kong Concert), record stores, and schools. Two songs' audio files were attached to the questionnaire, and it was not disclosed which audio file was AI-generated or not. Then, the audience was asked to make a choice and the results were announced. After that, they filled out the remaining questions of the questionnaire and finally the questionnaires were collected for data statistics.

A total of 50 questionnaires were distributed. After the collection of the questionnaires, all questionnaires were strictly screened for validity. Through the examination of the logicity of questionnaire responses, the coherence of options, and the rationality of question answers, 33 questionnaires were determined to be valid and 17 were invalid. The invalid questionnaires mainly had problems such as numerous blanks, logical confusion, and issues such as some respondents not answering key questions, contradictory answers to the same question, and continuous selection of the same option by some respondents. These situations made the relevant questionnaires unable to provide reliable data for the research, so they were excluded.

After eliminating invalid questionnaires, a systematic data statistics and analysis were conducted on 33 valid questionnaires. In terms of identification results, the number of people who correctly identified AI-created popular music was 19, while the number of those who made incorrect identifications was 14. The overall identification success rate showed certain differences, reflecting the varying degrees of accuracy in listeners' identification of AI-created popular music. From the overall proportion, the proportion of those who chose A (Audio 1) was slightly higher than that of those who chose B (Audio 2) in the question "Do you think the music is A (Audio 1) or B (Audio 2)?" This indicates that, when considering multiple listener groups comprehensively, the view that Audio 1 is AI-created music is slightly more dominant, but the gap is not very significant, suggesting that listeners' judgment on AI-created music does not form a one-sided trend. There are also certain differences among different listener groups. This also reflects that the recognition degree of AI-created music by listeners is influenced by various factors. Different background and music preferences of listeners may have different judgment bases and standards. The view that Audio 1 is AI-created music is more prominent, but the proportion of those choosing B is also close to 40%, indicating that a considerable number of listeners still believe that Audio 2 is AI-created music. This once again emphasizes that there are differences in listeners' judgment on AI-created music, and there is no absolute dominant opinion. Different listener groups have significant differences in the recognition degree of AI-created music based on their own music knowledge levels, music style preferences, and experiences with AI music. This

difference reflects the diversity and complexity of AI-created music in terms of style and characteristics, which is difficult to be uniformly recognized by listeners. It also indicates that when studying the recognition degree of listeners on AI-created music, it is necessary to fully consider the characteristics and influencing factors of different listener groups.

In terms of the distribution of listener groups, there were 13 people for popular music listeners, 15 for other style listeners, and 5 for those with less exposure to music. This distribution covers different music preferences and frequencies of music exposure, providing a diverse data basis for research.

From the perspective of music knowledge foundation, there were 15 people with music knowledge foundation and 18 without. This classification helps to explore the influence of music knowledge reserves on the recognition degree of AI-created popular music.

Further subdividing the identification success rates of different listener groups, the identification success rate of popular music listeners was 0.36, those of other style listeners was 0.52, those with music foundation was 0.57, those without music foundation was 0.15, and those with less exposure to music was only 0.05. This indicates that there are significant differences in the identification of AI-created popular music among different listener groups. The identification success rate of those with music foundation is relatively high, possibly because they have music knowledge and literacy that enable them to better perceive the characteristics of AI-created music; while those with less exposure to music have a lower identification success rate, perhaps because they lack familiarity with music and are unable to accurately judge whether the music is AI-created.

In terms of identification basis, the number of people who chose smooth melody, regular rhythm, harmonious harmony, musical emotion, performance skills, and arranging rhythm as identification bases was 25, 15, 17, 28, 16, and 7 respectively. Among them, musical emotion became the most chosen identification basis by many listeners, which may imply that AI-created music has more obvious differences in emotional expression compared to human creation, and is easily captured by listeners; while the number of those who chose arranging rhythm was relatively small, possibly indicating that in the current level of AI creation, arranging rhythm is not a significant feature for distinguishing AI from human creation, or listeners have a lower sensitivity to this element. Through a detailed statistical analysis of the data from the valid questionnaires, these results provide important data support for further in-depth exploration of the influencing factors of listeners' recognition of AI-generated popular music. They help reveal the behavioral patterns and potential influencing factors of different listener groups during the recognition process, and offer reliable data for the drawing of research conclusions.

4. Conclusion

This study, through the statistical and analytical processing of data from 33 valid questionnaires, delved deeply into the recognition degree of the audience towards AI-generated popular music, and reached the following main conclusions: There are significant differences in the recognition ability of different audience groups towards AI-generated popular music. The success rate of recognition among audiences with musical background (0.57) is relatively high, while the success rate of recognition among those with less exposure to music (0.05) is extremely low, and the recognition ability of audiences without musical background (0.15) is also relatively weak. This indicates that musical knowledge foundation is an important factor influencing recognition, and audiences with professional music knowledge and skills are more capable of discerning AI-generated works from musical elements.

In terms of the basis for recognition, the number of people choosing music emotion as the basis for recognition was the highest (28), indicating that AI-generated music may have perceptible differences in emotional expression compared to human-created music, becoming a key clue for the audience to identify. Only 7 people chose the arrangement rhythm as the basis for recognition, suggesting that their ability to distinguish between AI and human creation is relatively low. This might be due to AI being increasingly close to human creation in this aspect, or it might be that the audience pays less attention to it.

Further analysis of the correlation between influencing factors shows that music knowledge foundation is positively correlated with the success rate of recognition. Audiences with musical background can more sensitively perceive the uniqueness of AI-generated music through their understanding of music theory and creative techniques, thereby making accurate judgments. The success rate of recognition of audiences with different music styles (0.52) is higher than that of popular music audiences (0.36), possibly because other music styles are more niche and unique, and the audience is more sensitive to their style characteristics. When AI-generated music involves these styles, it is more easily detected.

However, this study has certain limitations. The sample size is relatively small, with only 33 valid questionnaires, which may not fully represent the characteristics and behaviors of all audience groups, limiting the generalizability of the research results. In the questionnaire design, the questions regarding the basis for recognition might not be detailed enough, making it difficult to deeply explore the underlying reasons for the audience's judgments. Additionally, the AI-generated music and human-created music samples used in the experiment are limited, which may not cover all music types and creative styles, affecting the comprehensiveness of the research results.

To address these shortcomings, future research can expand the sample size to include different age groups, regions, and cultural backgrounds of audiences,

improving the representativeness of the research results. Optimize the questionnaire design by adding open-ended questions and in-depth interviews to obtain a more comprehensive understanding of the audience's recognition thinking. At the same time, enrich the selection of music samples, including music from different eras, genres, and generated by different AI creative technologies, to make the research results more universal and reliable.

From the analysis of the research results, as AI technology continues to develop in the field of music creation, its impact on the music industry and cultural dissemination is increasingly significant. The results of this study suggest that the music industry should consider the acceptance and recognition ability differences among different audience groups when promoting AI-generated music, and formulate targeted marketing strategies. At the cultural education level, AI-generated music can be included in music education content to cultivate audiences' understanding and appreciation of new music forms, improving the general music literacy of the public. Moreover, the research results also provide reference for resolving issues such as copyright disputes and creative norms of AI music, helping to promote the healthy and orderly development of the music industry in the technological wave.

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