

Re-Thinking Boundaries: The Evolution and Impact of AI in Music and Soundscapes

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Abstract

This essay offers a comprehensive review of the transformative role of Artificial Intelligence (AI) in music composition and soundscape generation, providing both a historical overview and a critical analysis of its impact. Tracing AI's evolution from its early applications in the mid-20th century to its sophisticated use in contemporary auditory arts, the paper explores how AI has reshaped creative processes, blurred traditional boundaries between music and soundscapes, and catalyzed the emergence of new genres. Additionally, it critically examines the ethical, cultural, and aesthetic challenges posed by AI's integration, addressing concerns such as creativity, authenticity, and the potential homogenization of musical outputs. By balancing both positive and critical dimensions, the essay aims to deepen understanding of AI's dual role in transforming not only creative methodologies but also the conceptual frameworks of the auditory arts.

Keywords: AI-generated music, artificial soundscapes, blurring between music and soundscapes, ethical implications of AI in music, cultural impact of AI sound generation.

1. Introduction

AI has emerged as a transformative force in the realms of music composition and soundscape generation, redefining traditional artistic processes and challenging established boundaries within auditory arts. This essay provides a comprehensive review of AI's integration into these fields, tracing its historical evolution from early algorithmic experiments to cutting-edge innovations such as Neural Networks and Generative Adversarial Networks (GANs). AI's role has

expanded beyond mere tools, fundamentally reshaping how music and soundscapes are conceived, produced, and experienced. While AI has catalyzed new forms of creativity and genres, its increasing influence raises important ethical, cultural, and aesthetic concerns. The potential homogenization of musical expression, questions of authenticity, and the diminishing role of human artistry are critical issues that warrant reflection. As AI blurs the distinctions between music and soundscapes, it invites us to reconsider fundamental concepts such as creativity, diversity, and the nature of artistic engagement. This duality—AI as both a force for innovation and a source of ethical dilemmas—is at the heart of this essay’s exploration.

The essay is structured into five key sections. First, a historical overview highlights the milestones in AI’s integration into music, tracing its development from early algorithmic compositions to more complex systems. The second section examines the evolution of AI-generated soundscapes, from their roots in environmental sound analysis to contemporary immersive sound experiences. The third section delves into AI’s role in blurring the boundaries between music and soundscapes, leading to the creation of new hybrid genres and auditory forms. The fourth section discusses the emergence of these novel forms, emphasizing the need for deeper critical analysis to understand their cultural and artistic implications. Finally, the fifth section critically reflects on the ethical, aesthetic, and cultural consequences of AI’s role in music and soundscapes, focusing on how AI influences the very nature of creativity and artistic expression. By exploring both the creative potential and the critical challenges AI presents, this essay seeks to provide a balanced perspective on AI’s impact on the auditory arts, offering insights into how this technology both enhances and complicates the landscape of music and soundscape generation.

2. A Brief Historical Overview of AI-Generated Music Composition

The integration of Artificial Intelligence (AI) in music composition marks not only a technical progression but also a profound shift at the intersection of technological innovation and artistic creativity. Over several decades, AI has evolved from a tool into a collaborative partner in the creative process, while also raising critical questions about the future of music and creativity (López de Mántaras, 2006).

The origins of AI in music date back to the 1950s and 60s, with groundbreaking experiments such as the use of Markov Chains. A notable milestone was the *Illiad Suite* (1957), where Hiller and Isaacson utilized stochastic processes to generate musical compositions (Hiller & Isaacson, 1957). Similarly, Pinkerton’s *Banal Tune Maker* (1956) demonstrated AI’s early potential in melody creation (Pinkerton, 1956). In the 1970s, advancements saw a fusion of Formal Grammars with AI in music composition. Steedman’s *Generative Grammar for Jazz* chord sequences (Steedman, 1977) highlighted the potential of these systems

for automated music generation. Concurrently, Rader's rule-based methodology for musical rounds (Rader, 1974) laid the foundation for more sophisticated systems. During this period, Lerdahl and Jackendoff also contributed to the dialogue between music theory and AI through their *Generative Theory of Tonal Music*, enriching understanding in music cognition and perception (Lerdahl & Jackendoff, 1983).

The 1980s and 90s witnessed significant advancements in AI music generation with the introduction of Neural Networks and Deep Learning. A pivotal work was David Cope's *Experiments in Musical Intelligence* (EMI), which generated compositions in the styles of legendary composers (Cope, 1987). This period also saw the use of Genetic and Evolutionary Algorithms, exemplified by Biles' *GenJam*, which evolved jazz solos (Biles, 1994), and Todd and Werner's work on evolving musical compositions over time (Todd & Werner, 1999). Kemal Ebcioglu's CHORAL system, which generated chorales in the style of J.S. Bach, further demonstrated AI's growing sophistication in music composition (Ebcioglu, 1993). The late 1990s expanded this further, incorporating principles like "chaos" and "self-similarity" in AI music (Harley, 1995; Miranda, 1999). Todd Winkler's interactive music systems, integrating live performances with computer-generated responses, added a new level of complexity (Winkler, 1998).

The 21st century marked the emergence of Agent-Based Systems, with François Pachet's *The Continuator* facilitating interactive music generation and bridging AI with human creativity (Pachet, 2003). Programs like *Orchestrator*, where multiple AI agents collaborated to create complex compositions, showcased the potential of cooperative AI. Innovations such as Sony's *Flow Machines* (2016), IBM's *Watson Beat* (2016), and AIVA (2016)—the first virtual composer registered with a music rights society—demonstrated AI's growing role in generating music across diverse styles. OpenAI's *Jukebox* (2020) represented a leap forward, creating music and lyrics in various genres. These advancements illustrate the contemporary trend where AI and human creativity intertwine, leading to novel musical expressions (López de Mántaras, 2017).

The evolution of AI-generated music, from early experiments with Markov Chains to advanced neural networks and agent-based systems, reflects significant technological progress and its profound impact on music. This journey has transformed both the methods and perception of composition. AI has shifted from being a mere tool to becoming a collaborator, fostering new and dynamic musical experiences. However, this transformation is vast and multifaceted, deserving a more detailed analysis that transcends the scope of this essay. Nevertheless, a critical question remains: do these AI systems truly innovate, or do they replicate patterns? While AI's contributions to music composition are evident, its dual nature requires ongoing reflection. On one hand, AI merges human ingenuity with technology, offering new possibilities in musical expression. On the other, concerns about creativity, diversity, and the reduction of

music to algorithmic formulas persist. As AI continues to evolve, its impact on the future of music composition necessitates deeper analysis.

3. Integration of AI into the Generation of Soundscapes

Parallel to the advancements in AI's application in music composition, AI has embarked on a transformative journey in the realm of soundscape generation. This evolution highlights another facet of AI's impact on the auditory arts, shifting from structured musical composition to the expansive and often abstract world of soundscapes.

The concept of the "soundscape," as an acoustic environment perceived by humans, was pioneered in the 1970s by R. Murray Schafer. His groundbreaking work, particularly in *The Tuning of the World* (1977), laid the foundation for understanding environmental sounds and the complex interplay between humans and their acoustic surroundings (Schafer, 1977, pp. 7-10). This early conceptualization shaped subsequent research, including the integration of AI into soundscape creation.

Although initial efforts to generate artificial soundscapes following Schafer's ideas were simpler, the most systematic use of AI in this domain began in the early 21st century. Researchers built upon Schafer's framework, using machine learning algorithms to replicate and understand the complex layers of environmental sounds. Notable contributions from this period include Adaptive Resonance Theory (ART) and neural networks (Carpenter & Grossberg, 2003), alongside methods developed by Tzanetakis and Cook (2002) for feature extraction and classification in music information retrieval systems, which proved applicable to soundscape generation. Additionally, Bello et al. (2005) developed algorithms for recognizing and classifying environmental sounds, while Smalley's theory of spectromorphology (2007) offered AI a framework for creating dynamic soundscapes that reflect the spatial and temporal qualities of natural environments (Hirst, 2003). This era also delved into the emotional and psychological effects of soundscapes, with researchers like Västfjäll (2003) exploring AI-generated soundscapes that evoke specific emotional responses.

The landscape of soundscapes transformed dramatically starting in the 2010s, marked by major technological advancements. In 2016, Google's Magenta project emerged as a significant initiative, translating theoretical research into tangible applications in AI-driven sound generation. This period also saw the rise of Generative Adversarial Networks (GANs), as detailed in Ian Goodfellow et al.'s foundational paper (2014). GANs, which involve two neural networks competing against each other, have proven instrumental in creating complex, life-like auditory environments. For instance, they have generated convincing replications of rainforest or urban soundscapes, enhancing the realism and im-

mersive quality of artificial environments (Ampuja, 2005). Such technology enables sound artists and researchers to produce soundscapes that closely resemble natural environments, expanding the possibilities for creative and analytical exploration in the auditory arts.

From the late 2010s onwards, AI's role in soundscapes became increasingly interactive and responsive. Projects like *The Ambient Walker* (2018) exemplified this shift by turning soundscapes into dynamic, interactive experiences. The field also expanded into therapeutic and emotional domains, with initiatives like the NIH and Kennedy Center's *Sound Health Network* (2023) exploring the intersection of music, health, and neuroscience. AI's current and future applications focus on predictive and interactive models, as seen in *Imaginary Soundscape* by Nao Tokui (2018), a web-based installation that integrates deep learning techniques to create immersive soundscapes based on user interactions with Google Street View.

Recent academic and practical contributions continue to shape the field of AI in soundscapes. Projects like *Ecoacoustic AI* use AI for biodiversity monitoring by analyzing and interpreting environmental soundscapes (Nieto-Mora, 2023). Similarly, researchers such as Barry Truax, a pioneer in acoustic ecology, have made significant strides with works on "soundscape composition" (Truax, 2017 and 2019). In urban planning, initiatives like *Sonic Urbanism* by Theatrum Mundi (2021) demonstrate practical applications of AI-generated soundscapes in creating more engaging urban environments. Furthermore, another research by Yuanbo Hou et al. (2023) emphasizes AI's potential in evaluating and managing soundscapes for environmental and social optimization, enhancing our understanding of how AI can influence human well-being while adding complexity to soundscape generation.

In summary, AI's development in soundscape generation over recent decades reflects a continuous expansion of technological and creative horizons. From its theoretical beginnings to its present state as a dynamic, predictive force, the integration of AI in soundscapes has profoundly reshaped how we conceive, interact with, and understand auditory environments. This evolution showcases AI's growing sophistication and transformative influence across various creative and analytical domains, underscoring the need for ongoing exploration and innovation in the field.

4. AI's Redefining Role in Music Compositions and Soundscapes

The implementation of AI in audio creation is not merely about revolutionizing production techniques; it represents a movement of transgression between structured musical compositions and the more abstract, organic realm of soundscapes. This confluence of technology, music, and ambient sound fosters new auditory experiences and musical forms, challenging and expanding our

conventional understanding of the auditory arts. Historically, as explored in *Audio Culture* edited by Christoph Cox and Daniel Warner (2017), soundscapes have mirrored aspects of musical composition, including rhythm, tonality, harmony, and dynamic contrast. Likewise, music has often incorporated elements of natural soundscapes, resulting in a symbiotic relationship between the two.

AI intensifies this interplay, seamlessly weaving these elements together with unprecedented creativity. In music, rhythm and harmony are structured and deliberate, while in natural soundscapes, these elements unfold more organically. AI's capacity to analyze, replicate, and augment sound patterns bridges this gap, merging and redefining the boundaries between musical compositions and organic ambient soundscapes. This process not only enriches the auditory landscape, creating a diverse spectrum of sounds, but also raises questions about the artistic value of these transgressions: do these AI-generated fusions represent a deeper artistic integration or a reconfiguration that risks homogenizing sound?

The fusion of music and soundscapes has implications beyond the realm of art itself. By creating immersive environments that engage audiences on multiple sensory levels, AI-generated soundscapes and compositions alter how listeners interact with and perceive auditory experiences. As such, this technological convergence not only expands the creative possibilities but also influences the cultural and psychological dimensions of auditory arts. The growing prominence of AI in music and soundscapes thus invites deeper reflection on its impact on society, including its potential to shape public perception, cultural memory, and the authenticity of sound experiences. This critical engagement underscores the importance of ensuring these artistic innovations retain their capacity to inspire and connect on a human level, even as they push the boundaries of traditional forms.

Traditionally, music has been understood as a structured arrangement of sounds, emphasizing melody, harmony, and rhythm, primarily shaped by human composers. Theorists like Leonard B. Meyer in *Emotion and Meaning in Music* (1956) emphasized these structured elements as central to the musical experience. Conversely, soundscapes have been perceived as the acoustic environments that surround us, focusing on ambient and environmental aspects rather than structured musical qualities. Schafer (1977, pp. 103-119) differentiates soundscapes from music by emphasizing their organic and ambient nature.

However, with AI's integration into sound, these distinctions are increasingly fluid. This fusion is evident in works like David Monacchi's *Eco-Acoustic Compositions* (2012), where AI adapts music based on environmental interactions, turning soundscapes into interactive musical experiences. In these compositions, music responds dynamically to both artistic decisions and environmental changes, illustrating a fluid blend of composed music and ambient soundscapes. Such projects highlight AI's potential for artistic innovation, but they also bring

up critical considerations regarding the value of these transgressions: do they deepen our connection to natural environments, or do they commodify and standardize nature's sounds?

AI algorithms, trained on vast datasets of both musical and environmental sounds, are now capable of generating compositions that seamlessly integrate elements from both spheres. For example, Google AI's *Magenta* project uses machine learning to create soundscapes that are musically coherent yet ambient, reminiscent of natural environments (DuBreuil, 2020). Similarly, NVIDIA's AI-generated birdsong merges natural sounds into musical compositions, creating pieces that embody both structured music and soundscape elements (Black, 2023). These examples illustrate AI's capacity to redefine the boundaries of auditory art, but they also raise the question of authenticity—whether these AI-crafted fusions can achieve the same emotional and cultural resonance as their human-created counterparts.

The realm of ambient music, significantly shaped by Brian Eno's work, such as *Ambient 1: Music for Airports* (1978), prioritizes tone and atmosphere over conventional musical structures. By harnessing early forms of AI, this genre has evolved to produce unending streams of ambient sound, as epitomized by projects like *DADABOTS* (2017), a collaboration that fuses music with mathematics. These efforts enable the creation of music that is seamless and perpetually evolving, pushing beyond the traditional creative boundaries faced by human composers. However, this continuous evolution also invites a critical reflection on the real value of such music: while it undoubtedly expands the sensory and creative possibilities, it risks diminishing the distinct role of human creativity, as automated processes increasingly shape the auditory experience.

To summarize, AI's integration into music and soundscape generation represents a paradigm shift in how we perceive, create, and interact with sound. By eroding traditional boundaries, AI facilitates the emergence of new genres and listening experiences that challenge our understanding of what music can be, as argued by composers and theorists like David Cope in *Computer Models of Musical Creativity* (2005). This evolution opens an exciting chapter in the auditory arts, where the limits are defined not only by the imagination of creators but also by the capabilities and critical implications of AI in reshaping the musical landscape.

5. The Emergence of New Genres: AI as the Catalyst

The discussion of AI's shifting role in music compositions and soundscapes reveals that these technological advancements have not only transformed existing genres but also catalyzed the emergence of entirely new forms of musical and auditory expression. These new forms, born from the fusion of AI-induced

soundscapes and music, defy traditional categorizations and signify a significant cultural shift in the auditory arts. However, while these innovations expand creative possibilities, they also challenge conventional ideas about authorship, authenticity, and the essence of musical identity.

One of the most influential areas is generative music, where AI algorithms generate continuous streams of original compositions. This genre, thoroughly examined by Eduardo R. Miranda (2021), represents a departure from conventional music composition, as algorithms produce compositions that are not only endless but also continually evolving (Cope, 2005). This innovation challenges the traditional concept of a fixed “piece” of music. However, while this generative approach expands the boundaries of creativity, it raises concerns about whether these compositions, which may lack human intervention, truly embody the emotional and artistic depth associated with traditional music.

Similarly, ambient music has evolved remarkably through AI technologies. From Brian Eno’s early emphasis on atmosphere over melody (1978) to contemporary AI-driven approaches, the genre has expanded to incorporate complex, layered soundscapes that blend natural and urban elements. As Miranda highlights in *Readings in Music and Artificial Intelligence* (2000), these AI-generated environments provide immersive, organic experiences that mirror the fluidity of our acoustic surroundings. Yet, as AI increasingly automates this process, there is a growing concern about the potential loss of artistic intentionality and whether such automated soundscapes dilute the human touch that once defined the genre.

The field of electroacoustic music has also seen a significant transformation. Historically characterized by the fusion of electronic and acoustic sounds, this genre now incorporates AI-generated soundscapes that interact seamlessly with traditional instruments. Simon Emmerson (2007) describes how this evolution blurs the lines between human and machine, as AI blends artificial and natural sounds into a unified auditory experience. This integration opens new artistic avenues but also prompts critical reflection on the extent to which AI’s influence might overshadow the unique contributions of human musicianship.

In film music and cinematic scores, AI has become an indispensable tool, reshaping the way soundtracks are composed and integrated with visuals. Traditional film scoring, once reliant on manual composition techniques, has been revolutionized through AI’s ability to generate adaptive soundscapes that respond to on-screen action dynamically (Newton Lee, 2014). This technology enhances the immersive experience for audiences, but it also raises questions about whether such reliance on algorithms risks standardizing and automating the emotional nuances that composers typically bring to their work.

Beyond these established genres, the advent of AI has led to the rise of interactive soundscapes, particularly in art installations and experiential settings. These AI-enhanced soundscapes, which respond to environmental changes or user interactions, have become increasingly prominent (Blessner & Salter, 2006). As described by Rose Luckin in *Machine Learning and Human Intelligence* (2018), AI's ability to create responsive and evolving sound environments enriches the experience for audiences. However, the shift towards AI-driven interaction also necessitates a critical look at the changing role of the artist—does AI's involvement in interactive art installations diminish the creative agency of the composer, or does it expand it in ways that traditional methods could not?

The emergence of these AI-driven musical forms and genres represents a continual rethinking of our auditory landscape. This development goes beyond introducing new types of music; it signifies a redefinition of how we understand and interact with sound, blending the roles of composer and technologist, and merging music with environmental and digital contexts. While AI's evolving capabilities suggest that future genres may develop in ways that are currently unimaginable, this evolution also underscores the need for an ongoing critical assessment. It is vital to ensure that while AI opens new creative possibilities, it does not come at the expense of artistic diversity, originality, and the depth of emotional engagement that have historically defined music and soundscapes.

6. Evaluating the Artistic and Cultural Impact of AI in Music and Soundscapes

The integration of AI into music and soundscape generation marks a significant technological milestone, presenting a duality in its impact—an interplay between innovation and critical concern. On one hand, AI's capabilities in crafting complex, adaptive, and innovative auditory experiences represent a leap forward in creative expression, allowing for the exploration of previously uncharted auditory realms and challenging traditional definitions of music and ambient sound.

However, this advancement raises pivotal questions about authenticity and creativity in the age of AI. One critical aspect is the perception of sound: does AI-enhanced music and soundscapes provide a genuine experience, or do they manipulate the listener's sense of reality? This concern extends to the essence of human artistry, questioning whether the blurring of lines between AI and human creativity signifies an enhancement of the arts or a potential decline. As AI reshapes the auditory landscape, it forces us to reconsider the future role of human artists in an increasingly algorithm-driven domain. Musicians, artists, and creators now bear a new responsibility to critically engage with AI technologies, reflecting on how these tools influence their craft and how they can be used to preserve artistic integrity and innovation.

The debate over the authenticity and artistic value of AI-generated music and soundscapes is not just about originality but also the potential loss of the human touch—the emotional depth, intentionality, and personal expression that traditionally define art. To frame these concerns, Nick Bostrom, in *Superintelligence: Paths, Dangers, Strategies* (2014), offers a forward-thinking perspective. While his analysis primarily focuses on AI's future implications, it also provides valuable insights into its capabilities and limitations, contextualizing AI's role in reshaping the realm of music.

In response to these challenges, the role of art and artists extends beyond passive adaptation to active critique and engagement with AI technologies. Art becomes a space where AI's limitations and societal impacts are exposed. In an age where algorithms increasingly dominate creative processes (Pasquinelli, 2023), artists have a crucial role as critics, revealing the power structures embedded within AI systems. By disrupting AI's automated processes, artists interrogate the influence of technology on creativity and provide a platform for reflection, ensuring that AI's integration remains ethically responsible and transparent. This approach underscores the potential for art to redefine the narrative around AI, emphasizing its role as an active participant in shaping and critiquing technological developments.

Furthermore, this critical engagement is not merely a necessity but also an opportunity for artists. By actively participating in the development and use of AI technologies, artists have the potential to influence and shape the trajectory of AI integration in the auditory arts. This proactive stance allows for the preservation of artistic diversity and cultural richness while expanding the scope of sound art in innovative ways. As Joel Chadabe (1997) and Claire Anscomb (2022) suggest, when artists collaborate with AI, they can harness its capabilities to enhance their own creative output, ensuring that technology serves as a complement rather than a replacement. This responsibility requires artists not only to master AI as a tool but also to remain critically aware of its implications for creativity, cultural diversity, and artistic identity. Such ongoing engagement offers a pathway to balance technological possibilities with the fundamental values of artistic expression.

AI's influence on the cultural and creative diversity of music and soundscapes is nuanced and complex. On one side, there is concern that an over-reliance on AI could lead to a homogenization of music, as algorithms generate content based on existing data, potentially reinforcing prevailing trends. Arthur I. Miller's *The Artist in the Machine: The World of AI-Powered Creativity* (2019) explores these implications, highlighting AI's impact on creative diversity. Conversely, AI also holds the potential to democratize music creation, breaking down traditional barriers. López de Mántaras (2017, p. 17-20) discusses how AI enables those without formal musical training to engage in creative endeavors, introducing diverse cultural influences into the musical landscape. This duality

underscores the delicate balance AI must strike between the risk of homogenization and the opportunities for democratization and cultural inclusivity. Artists, therefore, play a pivotal role in navigating this balance, ensuring that AI's democratizing potential does not come at the expense of artistic uniqueness and cultural richness.

As AI becomes more embedded in the auditory arts, its ethical and societal implications become increasingly important. Central to these discussions are issues such as copyright and ownership of AI-generated content, the risk of algorithmic bias, and AI's impact on the economic landscape of the music industry. Additionally, the societal influence of AI-generated music and soundscapes, particularly concerning accessibility and inclusivity, is an emerging concern. These challenges extend beyond legalities, touching on fundamental values and ethical principles that underpin the creative fields (Liao, 2020). The integration of AI into these realms calls for a thoughtful examination, ensuring that these advancements contribute positively to the industry and society while addressing potential ethical dilemmas. Artists, creators, and musicians must play an active role in this critical engagement, advocating for responsible use of AI while shaping its future in ways that benefit both creativity and society.

To sum up, AI's influence on music and soundscape generation brings both immense opportunities and complex challenges. This evolution calls for a continuous, critical examination of how technology intersects with and reshapes creative processes. Focusing on meaningful outcomes, artists and technologists can preserve the essence of music and soundscapes, ensuring they remain deeply connected to human creativity and expression. Achieving this balance allows for the development of an auditory landscape that is not only technologically innovative but also culturally and artistically enriching.

7. Conclusion

The integration of AI in music and soundscape generation marks a transformative phase in the auditory arts. This essay has traced the historical evolution of AI in these fields, showing how technological advancements have enhanced creative capabilities and led to the emergence of new genres and immersive auditory experiences. The fusion of AI with music and soundscapes has redefined auditory creation, challenging traditional perceptions and inviting a more multi-dimensional engagement with sound.

This evolution also prompts critical reflections on creativity, authenticity, and the role of human artists in an increasingly AI-driven landscape. By addressing these concerns, the essay has examined the authenticity of AI-enhanced music, the risks of homogenization, and the ethical implications of AI-generated con-

tent. Despite these challenges, AI's influence in the auditory arts presents opportunities for democratization and cultural inclusivity, broadening who can create and what can be expressed through sound.

As AI continues to shape the landscape of music and soundscapes, it is essential to maintain a balanced perspective. Embracing technological possibilities while being vigilant about their implications ensures that the essence of music and soundscapes remains rooted in human creativity and expression. The trajectory of AI in the auditory arts is still unfolding, and its future promises further innovation, redefinition, and expansion of our auditory horizons.

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