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MUSICAL TIME IN ALGORITHMIC AND AI-GENERATED MUSIC: FROM DETERMINISTIC TO EMERGENT TEMPORALITY

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SUMMARY. This article examines musical time in algorithmic composition and AI-generated music, focusing on the shift from deterministic algorithmic models of the twentieth century to emergent generative models of the twenty-first century. Musical temporality is considered as the outcome of computational procedures that organize musical processes through algorithmic and statistical models. The study employs a comparative analytical approach combining theories of musical time, research on algorithmic composition, and studies of artificial intelligence in music. Analysis of works by Lejaren Hiller and Leonard Isaacson, and by Iannis Xenakis shows that twentieth-century algorithmic composition produces a deterministic type of musical time characterized by procedural generation and structural fixity. In contrast, AI-generated music demonstrates an emergent temporality in which temporal structures arise during the generative process through probabilistic and data-driven models. The article proposes a conceptual distinction between deterministic algorithmic time and emergent AI-generative temporality, offering a framework for understanding the transformation of musical time in contemporary digital culture.

Keywords: musical composition, musical time, musical temporality, algorithmic composition, AI-generated music, compositional models.

Introduction

Musical art of the second half of the twentieth and the beginning of the twenty-first centuries has been marked by an active interaction with modern technologies and the rapid development of computational systems. This interaction has significantly expanded traditional compositional methods and contributed to the emergence of new artistic forms and approaches to musical creativity.

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In this context, the use of computer technologies in music composition and the emergence of algorithmic compositions have become particularly significant. In such works, formalized procedures are employed to generate musical structures. Although algorithmic approaches to music creation have a long prehistory, their full integration into compositional practice occurred with the development of electronic and computer music in the mid-twentieth century (Aung et al., 2025; Galanter, 2003, 2008; Nierhaus, 2009). This period was also marked by a significant expansion of the sonic domain due to the emergence of artificial sound sources and digital sound processing technologies.

Pioneers of computer music, Lejaren Hiller and Leonard Isaacson, created one of the first computer-generated compositions, *Illiac Suite* (1955–56), which initiated the further development of algorithmic approaches to composition. As Roads notes, "a composition algorithm serves as a generative engine for music creation"[2].

In the twenty-first century, algorithmic thinking in music has undergone significant transformations with the emergence of artificial intelligence technologies and AI-generated composition[3]. These developments have not only opened new possibilities for composition but have also changed traditional notions of creativity, authorship, and the temporal organization of musical works. While classical algorithmic composition is based on deterministic rules, contemporary AI models – particularly deep neural networks – operate through statistical analysis of large musical datasets, forming probabilistic models of temporal and structural development.

Thus, algorithmic composition, which emerged in the second half of the twentieth century as a system of deterministic procedures, has transformed in the twenty-first century into a fundamentally new phenomenon – AI-generated composition based on artificial intelligence and machine learning. These technological shifts are not merely instrumental but also lead to a profound transformation of musical temporality that requires theoretical reconsideration.

Algorithmic musical compositions of the twentieth and twenty-first centuries therefore form two paradigmatic approaches grounded in different conceptions of musical time: deterministic algorithmic time and AI-generative temporality. Their fundamental differences become a key to understanding the nature of musical time in contemporary musical art.

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[2] Roads, Curtis. *Composing Electronic Music: A New Aesthetic*. Oxford University Press, 2015, p. 325.

[3] Mycka, Joanna, and Jacek Mańdziuk. "Artificial Intelligence in Music: Recent Trends and Challenges." In *Neural Computing and Applications*, vol. 37, 2025, pp. 801–839. https://doi.org/10.1007/s00521-024-10555-x.

The methodology of the study is based on a conceptual-analytical approach to musical temporality as a result of algorithmic and generative processes. The focus is placed on the way musical time is organized as a consequence of the application of algorithms of different nature. The research is conducted in the form of a comparative typological analysis that contrasts two historically successive yet fundamentally different modes of algorithmic thinking: deterministic procedural algorithmic time in the music of the second half of the twentieth century and probabilistic, statistically conditioned time in AI-generated music of the twenty-first century. The analytical perspective focuses on the structural aspects of the organization of musical time, considering musical material primarily as a temporal process. Particular attention is given to the principles of temporal structure formation (projected or emergent), the relationship between local and global temporal processes, as well as the role of repetition, variability, and perceptual processes in shaping the temporal coherence of a musical work. The theoretical interpretation of the results draws on a combination of musicological and cognitive approaches to the study of time, within which musical temporality is understood as a multi-level structure that includes formal, perceptual, and cultural dimensions.

This study adopts an integrated theoretical framework that combines historical, technical, perceptual, and cultural perspectives on musical temporality in algorithmic and AI-based composition. First, it draws on theories of algorithmic composition that conceptualize music as the outcome of formalized procedures and rule-based systems. In these approaches, musical time is typically projected within the compositional model as part of a predefined structural design. Foundational work in computer-assisted and formalized composition therefore treats temporality as an explicitly designed parameter rather than an emergent process (Hiller & Isaacson, 1959, 1993; Xenakis, 1992; Roads, 2015; Nierhaus, 2009; Galanter, 2003; Fernández & Vico, 2013).

Second, the framework incorporates research on AI-based music generation, which documents the transition from rule-oriented systems to statistical and data-driven models such as deep neural networks. In these systems, musical events are generated incrementally on the basis of learned probabilistic dependencies, often resulting in locally coherent but less strongly predetermined global temporal organization (Briot, Hadjeres, & Pachet, 2019; Herremans, Chuan, & Chew, 2017; Mycka & Mańdziuk, 2025).

Third, musicological and cognitive theories of musical time are employed to address perception and interpretation, emphasizing the listener's role in constructing temporal coherence through processes such as repetition, expectation, and metric structuring (Kramer, 1988; Clarke, 2005; London, 2012; Margulis, 2014; Zbikowski, 2017).

Taken together, these perspectives allow AI-generated musical time to be interpreted as probabilistic, emergent, and perceptually mediated, rather than fully predetermined by a formal compositional structure.

Conceptual model of musical temporality

A fundamental characteristic of a musical work is its unfolding in time, which is determined not only by the duration of sounding but also by the structural organization of musical material and the specific features of its perceptual reception. Temporality forms the space in which a musical work acquires form and meaning, while musical thinking itself gains a direction of development.

Drawing on the traditional trajectory of the musical work's existence – *composer → performer → listener* – it is possible to identify a multiplicity of temporal levels that interact in the processes of musical creation and reception. Such an approach allows the musical work to be considered as a system of interacting temporal levels in which different layers of temporality overlap and together shape the integrity of the artistic process.

In the works of Jonathan Kramer[4], musical time in contemporary music is described as a system of different temporalities that may coexist within a musical work. He emphasizes that time in modern music appears not only as a linear succession of moments (*absolute time*), but also as a plurality of temporal forms. One such model is *vertical time*, in which musical events are not clearly differentiated into past, present, and future but are perceived as relatively autonomous fragments that do not necessarily follow an overarching chronological logic of musical unfolding.

The psychological dimension of temporality becomes particularly significant in the research of Eric Clarke[5], who interprets the listener as an active participant in the formation of musical experience. In this perspective, the temporal dimension emerges not only from the musical text itself but also from the interaction with the listener's cognitive processes, which organize connections, accents, and meaningful contours. Elizabeth Margulis6 highlights the role of memory, repetition, and expectation as mechanisms that structure the experience of time in music. Musical time, therefore, is formed through the interaction between musical events and the listener's perceptual processes.

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[4] Kramer, Jonathan D. *The Time of Music: New Meanings, New Temporalities, New Listening Strategies*. Schirmer Books, 1988.

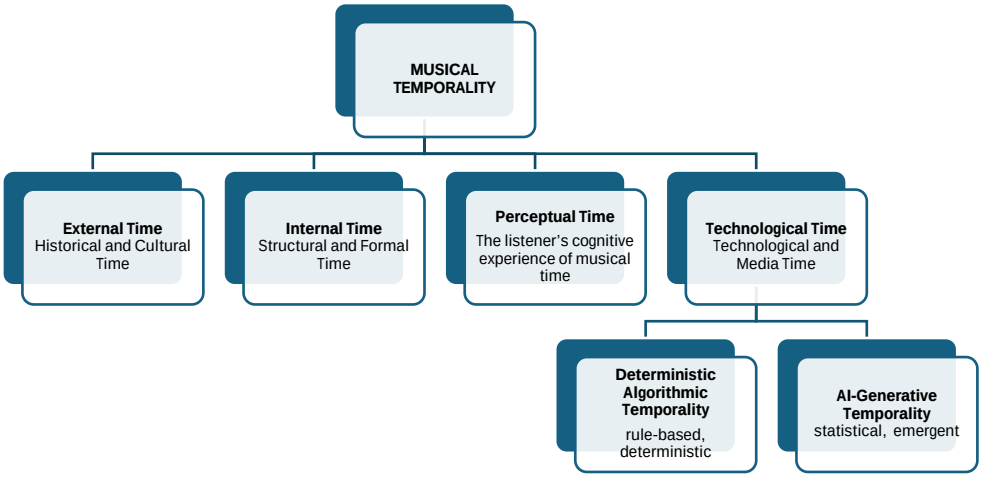
[5] Clarke, Eric. *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning*. Oxford University Press, 2005.

[6] Margulis, Elizabeth Hellmuth. *On Repeat: How Music Plays the Mind*. Oxford University Press, 2014.

The concept proposed by Justin London[7] further expands this understanding by emphasizing the dual nature of musical time: its physical parameters coexist with cognitive models, particularly metric organization, which is formed in the listener's mind. Lawrence Zbikowski[8] develops the cognitive approach in musicology and draws attention to the listener's ability to structure sequences of sounds into coherent and meaningful patterns that shape the temporal organization of a musical work.

Drawing on these approaches, musical temporality may be understood as a system of interacting levels (Figure 1).

Figure 1



Conceptual model of interacting levels of musical temporality

Within this model, algorithmic and AI-generated composition operate primarily at the level of technological temporality while simultaneously interacting with perceptual and structural temporal processes.

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[7] London, Justin. *Hearing in Time: Psychological Aspects of Musical Meter*. 2nd ed., Oxford University Press, 2012.

[8] Zbikowski, Lawrence M. *Foundations of Musical Grammar*. Oxford University Press, 2017.

Algorithmic Temporality in Twentieth- and Twenty-First-Century Music

Contemporary media and computational technologies significantly transform the principles of organizing musical time. In algorithmic and AI-generated composition, the temporal organization of music is increasingly determined by computational processes that generate musical events rather than exclusively by traditional metric or performative parameters. In such practices, musical time acquires the characteristics not only of an artistic but also of a technological construct that may function partially independently of direct compositional intention.

Algorithmic and AI-generated composition introduce new models of temporality in which the logic of musical unfolding is determined not only by the composer's intention but also by algorithmic or statistical processes that organize the order and duration of musical events. In these practices, the temporal structure of a work is increasingly shaped by computational mechanisms, transforming conceptions of authorship, structure, and musical time in contemporary musical culture.

Deterministic Algorithmic Time in Twentieth-Century Music

A new model of organizing musical time emerged in the mid-twentieth century with the development of algorithmic composition. As C. Roads[9] notes: "The process of composition is essentially creative decision-making: up or down, long or short, sparse or dense, loud or soft, same or different, etc. Out of a universe of possibilities, we choose specific elements and order them in time to construct a musical morphology. Computer-assisted composition means delegating certain decisions to the computer".

In such practices, temporality is determined not by intentional dramaturgy or the psychology of perception but by formalized procedures. A musical work emerges as the result of applying an algorithm, while time functions as a parameter embedded within the structure of the compositional model. As Nierhaus[10] observes: "…an algorithm may be, based on the abovementioned definitions, very generally described as a formalizable and abstracting procedure which – applied to the generation of musical structure – determines the field

[9] Roads, Curtis. *Composing Electronic Music: A New Aesthetic*. Oxford University Press, 2015, p. 337.

[10] Nierhaus, Gerhard. *Algorithmic Composition: Paradigms of Automated Music Generation*. Springer, 2009, p.2.

of application of algorithmic composition". Thus, in algorithmic composition musical time becomes a parameter embedded within the procedural structure of the compositional model.

Algorithmic composition typically relies on formal structures, mathematical models, stochastic procedures, and graphical and computational transformations. These approaches generate a deterministic type of musical time in which form emerges as a consequence of a formal procedure rather than from the development of musical thought in the traditional sense.

In early examples of computer and algorithmic composition, musical time appears not as a dramaturgical development of events but as a formalized parameter produced by the operation of a programmatic or mathematical procedure. In the works of Lejaren Hiller and Iannis Xenakis, temporality is generated at the level of the algorithmic model itself, which allows this type of musical time to be described as procedurally determined temporality.

Lejaren Hiller and Leonard Isaacson: Algorithmic Order and Procedurally Determined Time

In the computer-generated composition *Illiac Suite* (1955–56), created by Lejaren Hiller and Leonard Isaacson, musical time emerges not as the result of compositional development but as a consequence of the algorithmic organization of musical parameters. The temporal organization is determined by a formalized system of rules operating at the level of an algorithmic model. As Gerhard Nierhaus[11] notes in his analysis of Illiac Suite: "Each of the movements, so-called "experiments," was dedicated to the realization of a special musical concept. In "experiment four," Hiller and Isaacson use Markov models of variable order for the generation of musical structure. Amongst others, these Markov models serve to select notes under various musical aspects, like the succession of skips and stepwise motions, the progression from consonant to dissonant intervals or even sound textures, which can be related to a tonal center in order to establish a distinct tonality".

In this composition, rhythmic relationships, durations, and formal segments are determined by the logic of a computational process that regulates permissible combinations of intervals and temporal values. Each experiment is constructed according to a specific set of rules. For example, the contrapuntal techniques of Josquin des Prez and Giovanni Pierluigi da Palestrina serve as the basis for the first two experiments, while the subsequent experiments

[11] Ibid., p. 72.

rely on more flexible algorithmic procedures for generating musical structures. The authors[12] themselves describe the compositional idea of the work as a gradual transition from randomness to order: “The music so produced was arranged to start with random white-note music [meaning here the white keys on a piano] and then by the successive addition of counterpoint rules was forced to progress gradually to more and more cantus firmus settings. We thought this procedure would provide an example of how order or redundancy might be brought into a musical texture”.

In this work, musical time functions as a structural variable embedded within the algorithm, and its organization is determined by a system of formal rules. This is manifested in the absence of traditional temporal tension and teleological direction in the musical process. Although the algorithm produces ordered temporal structures, these structures are perceived more as the result of a procedural mechanism than as a process of musical development.

Thus, in *Illiac Suite* the algorithm acts as a structural regulator of time, while musical form emerges as the outcome of a computational procedure. In this case, time is deterministic and procedurally organized, which allows it to be interpreted as one of the early examples of algorithmic temporal thinking in twentieth-century music.

Stochastic Algorithmic Time in the Works of Iannis Xenakis

Another type of algorithmically organized time is realized in the stochastic compositions of Iannis Xenakis, particularly in works such as *Pithoprakta* (1955–56), *Achorripsis* (1957), and *ST/10-1, 080262* (1962). In these compositions, the organization of musical time is based on mathematical models derived from physics and probability theory, which determine the parametric distribution of sonic events within the temporal continuum. Xenakis conceptualized stochastic composition as the application of mathematical models and probability distributions to musical structure, thereby expanding algorithmic composition beyond rule-based procedures toward probabilistic systems[13].

A representative example is the orchestral work *Pithoprakta*, in which temporal organization is based on statistical modeling of the motion of sound masses by analogy with the kinetic theory of gases. The work is written for an

[12] Hiller, Lejaren, and Leonard Isaacson. “Musical Composition with a High-Speed Digital Computer.” In *Machine Models of Music*, edited by Stephan M. Schwanauer and David A. Levitt, MIT Press, 1993, p. 9.

[13] Xenakis, Iannis. *Formalized Music: Thought and Mathematics in Composition*. Pendragon Press, 1992.

expanded orchestral ensemble of forty-six string instruments, two trombones, and percussion, and unfolds as a sequence of large-scale sonic textures separated by structural articulations, producing a segmented temporal organization.

Individual instrumental parts are governed by probabilistic distributions governing density, pitch, and duration. As a result, musical time is articulated not as a sequence of individual events but as a continuous macro-process of evolving sonic texture. Within this model, temporal organization is not constructed through thematic development or linear dramaturgy. Instead, it emerges as a statistically organized field in which temporal meaning arises at the level of the global dynamics of the sound mass, through changes in density, intensity, and spectral distribution.

This type of temporality is characterized by:

• the absence of stable metric organization;

• the predominance of macro-temporal processes over local event-based structures;

• the perception of time as fluctuations in the density and intensity of sonic events;

• the subordination of local variability to an overarching mathematical regularity.

Despite the apparent randomness at the level of individual events, stochastic time in Xenakis's works remains structurally determined at the level of the model: parameters, boundaries, and probability distributions are specified in advance and do not change during performance or perception. In this sense, randomness functions not as a manifestation of indeterminacy but as a tool for implementing a pre-defined structural logic.

Thus, stochastic time in Xenakis's music may be understood as a form of model-controlled temporality, in which probabilistic processes operate within strictly predefined mathematical constraints. In this sense, Xenakis's stochastic compositions represent a distinctive type of algorithmic time that differs from the procedural logic of Illiac Suite while sharing a fundamental feature with it – the independence of temporal organization from the dramaturgical logic of listener perception.

The *UPIC system*, developed by Xenakis in the 1970s, represents an extreme case of algorithmic construction of musical time. In compositions created using *UPIC*, temporality is projected directly in graphical form: the horizontal axis corresponds to time, the vertical axis to pitch, and the shapes of drawn lines determine the dynamics of sonic processes. A representative example is *Mycenae Alpha* (1978), in which the temporal structure is fixed in a visual model prior to sounding and is reproduced algorithmically without the mediation of performative interpretation. In such a model, musical time

functions as a spatially constructed object rather than as a process emerging in performance or perception. In this sense, the graphical temporality of *UPIC* represents a limiting form of deterministic algorithmic thinking and marks the boundary between the algorithmic temporality of the twentieth century and the emergent temporality of AI-generated music in the twenty-first century.

The procedural models of Lejaren Hiller and Leonard Isaacson, the stochastic systems of Iannis Xenakis, and the graphical projection of time in UPIC together illustrate how twentieth-century algorithmic composition conceptualized musical temporality as a formally constructed structure. In these approaches, musical time is determined by predefined models – procedural, statistical, or graphical – rather than emerging through performance or listener-oriented temporal development. This paradigm of model-based temporality forms the conceptual background against which AI-generated musical time of the twenty-first century emerges.

Musical Time in AI-Generated Music

Music generated by contemporary artificial intelligence systems demonstrates a fundamentally different type of temporal organization compared to deterministic algorithmic compositions of the twentieth century. Whereas classical algorithmic composition relied on predefined rules and formal procedures, AI-based music generation is based on statistical dependencies between musical events (probabilistic relationships between notes, chords, and other parameters) identified through the analysis of large corpora of musical data. In this context, musical time ceases to be a predesigned structure and instead emerges as a probabilistic process formed directly at the moment of generating musical material.

In AI music generation systems, temporal organization arises from the computation of conditional probabilities between successive musical events: notes, chords, timbres, or sound fragments, rather than from the realization of a predesigned formal structure. This generative principle is implemented in contemporary machine-learning models, including recurrent neural networks (LSTM), transformer architectures, and diffusion models[14]. These approaches are employed in both symbolic and audio-based music generation systems such as Magenta, MuseNet, and MusicLM.

[14] Fernández, José D., and Francisco Vico. “AI Methods in Algorithmic Composition: A Comprehensive Survey.” In *Journal of Artificial Intelligence Research*, vol. 48, 2013, pp. 513–582.

Such models do not operate according to compositional logic in the traditional music-theoretical sense and do not have access to semantic or cultural-historical categories. As noted by Briot et al.[15], in contemporary AI music generation systems the musical process unfolds iteratively: each subsequent event is generated step by step on the basis of a limited local context rather than on a global representation of the work's form. In this sense, temporality in AI-generated music emerges as a probabilistic unfolding of a sequence of musical events rather than as the realization of a predesigned form.

The predominantly local (step-by-step) character of this temporal organization is also confirmed by functional typologies of contemporary automated music generation systems. In the classification proposed by Herremans et al.[16], musical composition is understood not as a single formal structure unfolding in time, but as a set of distinct functional processes such as melody, harmony, rhythm, and timbre, each of which can be algorithmically modeled relatively autonomously. Such decomposition reveals a fragmented mode of musical time in which temporality is formed at the level of individual algorithmic operations rather than as the realization of a predesigned teleological form.

Analytically, this implies that musical time in AI composition does not follow the principles of thematic development or dramatic direction. Even in models capable of retaining relatively long contexts, temporal coherence remains predominantly local and statistical rather than hierarchically organized. Unlike a human composer or deterministic algorithmic systems of the twentieth century, an AI model does not maintain a macro-temporal perspective of the work as a unified conceptual structure; instead, it operates through a sequence of musical events in which each subsequent moment is determined by probabilistic selection rather than functional necessity.

In a broader cultural dimension, AI-generated musical time also acquires a specific status. Unlike human creativity, which functions within the historical continuum of musical style, algorithmic models do not occupy a position within cultural time: they do not develop style or enter into dialogue with tradition, but merely model probabilistic configurations of already existing material. As a result, musical time partly loses the characteristics of historical directionality and appears as a simulation of stylistic temporal regimes.

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[15] Briot, Jean-Pierre, Gaëtan Hadjeres, and François-David Pachet. *Deep Learning Techniques for Music Generation, Computational Synthesis and Creative Systems*. Springer, 2019.

[16] Herremans, Dorien, Ching-Hua Chuan, and Elaine Chew. "A Functional Taxonomy of Music Generation Systems." In *ACM Computing Surveys*, vol. 50, no. 5, 2017, pp. 1-30.

An important aspect of AI-generated music is the perceptual formation of temporal meaning. Such models do not consciously produce meaning and lack the capacity for reflection; however, listeners tend to interpret the generated material in terms of repetition, development, or expectation. Consequently, temporal coherence emerges not within the algorithmic system itself but at the intersection of algorithmic generation and human perception, which gives this type of musical time a hybrid character.

The analysis presented above allows the temporal logic of AI-generated music to be summarized through several key characteristics.

Table 1

Characteristic	Description
Probabilistic	Temporal organization is based on statistical relationships between musical events rather than deterministic compositional rules.
Emergent	Temporal structures arise during the generative process instead of being predetermined by a formal compositional plan.
Acultural	AI models do not occupy a historical position within musical culture and therefore simulate stylistic configurations without participating in the evolution of style.
Hybrid	Temporal coherence emerges through the interaction between algorithmic generation and human perception.

Typological Characteristics of AI-Generated Musical Time

Therefore, AI-generated music represents a new type of temporality that cannot be adequately described either through the categories of deterministic algorithmic time of the twentieth century or through traditional musicological models of form and development. This type of time emerges as an emergent property of statistical processes and significantly transforms our understanding of musical form, authorship, and the very nature of temporal thinking in the musical art of the twenty-first century.

Two Regimes of Algorithmic Musical Time: Deterministic and Statistical

A comparative analysis of twentieth-century algorithmic composition and AI-generated music of the twenty-first century reveals a fundamental shift in temporal logic. Although both practices rely on computational procedures, the type of musical time they produce is qualitatively different. The main differences between these two regimes of algorithmic musical time can be summarized in the following comparative table.

Table 2

Dimension	20th-Century Algorithmic Composition	21st-Century AI-Generated Music
Nature	deterministic	statistical
Source of organization	formal rules, mathematical models	data-driven learning
Type of temporality	structural, procedural	probabilistic, emergent
Temporal logic	systematically predictable	variable, fluctuating
Authorship model	composer → algorithm	algorithm → listener (perceptual actualization)

Two Regimes of Algorithmic Musical Time: Deterministic and Statistical

In deterministic algorithmic composition of the twentieth century, musical time is projected in advance and fixed in the form of a procedure. Even in stochastic models, the temporal continuum remains controlled and structurally predictable. In this context, the algorithm functions as a tool for realizing the composer's intention, while temporality is derived from a formal model.

By contrast, in musical practices based on artificial intelligence, temporality emerges not as the realization of a predetermined plan but as the result of the statistical reproduction of probable relationships. Temporal organization often lacks a stable macrostructure and manifests itself through fluctuations, variable transitions, or unpredictable transformations. This indicates a shift in the very logic of algorithmic time from projected to emergent.

Another fundamental difference between these two types of algorithmic temporality concerns the role of the listener in the formation of temporal meaning. In deterministic algorithmic compositions of the twentieth century, temporal structures exist independently of the act of perception. In the case of AI-generated music, however, the situation is fundamentally different. The algorithm produces only a potential temporality: a set of events in which no clearly defined dramaturgical or semantic logic is embedded. It is the listener who, drawing on cultural experience, memory, and expectations, constructs an imagined temporal coherence. In this sense, musical time ceases to be exclusively a property of the work itself and appears instead as a joint product of algorithmic generation and human perception. This allows us to formulate the central thesis of the study: temporality in AI-generated music cannot be reduced to an algorithmic structure alone but is formed in the act of human perception. From this perspective, musical time appears as a multi-layered process encompassing compositional projection, algorithmic generation, and perceptual actualization.

Thus, in the twenty-first century, musical time increasingly functions not as a predetermined structural form but as an interpretive space in which the listener assumes the role of an active co-creator of temporal meaning. This implies a shift from objectified algorithmic time to perceptually actualized temporality, fundamentally transforming traditional conceptions of composition, form, and authorship in music.

Conclusions

The theoretical reconsideration of musical time as a key category of algorithmic and AI-generated composition is focused on identifying the fundamental differences between deterministic algorithmic models of the twentieth century and emergent generative models of the twenty-first century. The proposed approach makes it possible to view the algorithm not merely as a technical tool but as a factor that shapes specific types of musical temporality.

An analysis of the works of Lejaren Hiller and Leonard Isaacson, and Iannis Xenakis demonstrates that deterministic algorithmic time of the twentieth century is characterized by procedurality, structural fixity, the dominance of macrotemporal processes, and a fundamental independence from both performative interpretation and listener perception. In Hiller's works, musical time appears as the result of executing formalized rules, whereas in Xenakis's stochastic compositions it functions as a statistically organized field in which randomness operates within the framework of a predefined mathematical

model. The *UPIC system* represents the extreme case of this paradigm, in which musical time is entirely projected in spatial-graphic form and acquires the status of a fixed object.

The generalization of these approaches makes it possible to formulate a model of deterministic algorithmic time as structurally controlled temporality, in which the musical process unfolds not as the result of a composer's intention but as the realization of an algorithmic model. This model defines the historical boundary of twentieth-century algorithmic thinking while simultaneously creating the theoretical conditions for further transformations of musical time in the digital era.

Against this background, AI-generated music of the twenty-first century emerges as a fundamentally different type of temporality, in which temporal structures are not projected in advance but arise during the process of generation on the basis of statistical, learning-based, and data-driven models. Such musical time possesses an emergent character, and its coherence increasingly depends on the perceptual activity of the listener.

The main contribution of the study lies in the conceptual differentiation between deterministic algorithmic time and emergent AI-generated musical time, as well as in demonstrating their historical continuity and fundamental differences. The proposed typology makes it possible to consider contemporary musical practices not as a radical break with the tradition of algorithmic composition but as its profound reinterpretation, in which the very status of musical time changes – from a structurally predetermined object to a dynamic process formed at the intersection of algorithms, data, and listener experience.

Future research may focus on a deeper analysis of specific AI-generative systems, the study of the listener's role in constructing temporal meaning, and the application of the proposed model to intermodal and multimedia practices in contemporary digital culture.

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