Research Article

Transforming music theory in the digital age: A systematic literature review of popular music production

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Article Info	Abstract
	This study examines how traditional music theory concepts are transformed and reconceptualized in contemporary popular music production through a systematic literature review. This article is a systematic literature review (conducted in line with PRISMA guidelines), synthesizing peer-reviewed scholarship published between 2000 and 2025 through predefined inclusion/exclusion criteria and thematic coding. Core categories of classical music theory—harmony, counterpoint, rhythm, form, and timbre/orchestration—are reconsidered within the context of Digital Audio Workstation (DAW)-based production practices, loop-based composition, sampling, and electronic sound design. Analytical studies in genres such as pop, rock, hip-hop, and Electronic Dance Music (EDM) demonstrate that functional harmony has evolved into cyclical and layered structures, meter and pulse theory has shifted toward microtime and groove concepts, and traditional orchestration understanding has transformed into track-based and timbre-focused approaches. This review examines academic sources published between 2000 and 2025, emphasizing the need to expand music theory education to encompass popular music practices, and proposes DAW-based analytical methods, groove-oriented theoretical frameworks, and the treatment of timbre/mix as structural categories. The study systematically compares conceptual differences between traditional and digital approaches through comparative frameworks and supports findings with concrete examples from contemporary artists including The Weeknd, Billie Eilish, and Calvin Harris.

To cite this article

Introduction

Traditional music theory is a conceptual toolkit derived from the Western art music tradition, typically establishing a notation-based analytical framework. This toolkit is organized under fundamental headings such as harmony (chord progressions, functional tonality, cadences), counterpoint (polyphonic writing, voice-leading rules), rhythm and tempo (meter, pulse, rhythmic motifs), form (structures such as sonata form, rondo, theme and variations), and orchestration/timbre (instrument families, register, dynamic balance) (Danielsen, 2016, pp. 1-15; von Appen et al., 2016, pp. 1-20). These concepts have been developed over centuries within the context of European classical music and constitute the foundational pillars of music education.

However, since the second half of the 20th century, the prominence of popular music genres (pop, rock, jazz, R&B, hip-hop, electronic dance music) in global music production and consumption has steadily increased. Particularly after

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the 1980s, the proliferation of digital technologies, the standardization of the MIDI (Musical Instrument Digital Interface: technical standard enabling musical instruments to communicate with computers) protocol, and the accessibility of Digital Audio Workstations (DAWs) on desktop computers by the 2000s have fundamentally transformed music production practices (Reuter, 2021, pp. 3-8). Today, professional and amateur musicians conduct a production process based on loop-based (recurring sound fragments), sampling-focused (extraction of sound segments from existing recordings), and timbre/sound design-centered approaches in DAW environments, rather than notation-based composition (Brovig-Hanssen et al., 2021, pp. 274-280).

This transformation has raised a significant question for the music theory discipline: To what extent is traditional music theory adequate in explaining popular music productions? Classical music theory was developed to analyze works created for acoustic instruments, predominantly notation-based, and produced within a specific composition-performance hierarchy. However, popular music operates within a production ecology centered on recorded sound, where production and mixing processes hold compositional significance, notation is often absent, and listener experience is shaped as much by studio recordings as by live performance (von Appen et al., 2016, pp. 25-40). Therefore, the direct application of traditional theoretical concepts to popular music carries risks of ignoring genre-specific practices and analytical inadequacy.

Digital Audio Workstations have democratized and transformed the music production process. The capabilities of equipment once found only in professional studios in the 1990s have become accessible through software such as Logic Pro, Ableton Live, or FL Studio running on laptop computers. This accessibility has moved music production to home studios and led to the emergence of a new musician profile referred to as the 'bedroom producer.' Consequently, a significant portion of contemporary popular music is produced by producers who have not received traditional conservatory education but have specialized in DAW software.

This paradigm shift has created a serious disconnect in music theory education and research. While music theory curricula still predominantly focus on 18th and 19th-century European art music repertoire, the music students consume and often produce in their daily lives cannot be adequately explained by these theoretical frameworks. Moore (2012, pp. 15-22) criticizes this 'repertoire gap' in music theory education and argues that the discipline must become more inclusive. Similarly, Temperley (2018, pp. 5-10) emphasizes the limitations of traditional theoretical tools in popular music analysis and proposes the development of new methodologies.

Over the past twenty-five years, numerous studies seeking to answer this question have been published in music theory and musicology literature. These studies discuss how traditional theoretical concepts transform in the context of popular music, what new concepts need to be developed, and how analytical methods should be diversified. While some researchers argue that classical theoretical tools can be adapted to popular music (Duinker, 2019; Exarchos, 2020, pp. 105-115), others propose that new analytical frameworks based on production practices, recorded sound, and DAW workflows need to be developed (Danielsen, 2016, pp. 45-70; Brovig-Hanssen et al., 2021, pp. 280-290; Reuter, 2021, pp. 10-15).

Research Question and Objective

The fundamental research question of this study is formulated as follows: How are traditional music theory concepts (harmony, counterpoint, rhythm, form, timbre/orchestration) being transformed in the digital production practices of contemporary popular music genres? What new conceptual frameworks are being developed?

To address this research question, the study systematically compiles and synthesizes academic sources published between 2000 and 2025. The sub-objectives are:

➢ To present methodological debates regarding the relationship between traditional music theory and popular music,

➢ To document conceptual transformations in the fields of harmony and counterpoint,

➢ To examine the reconceptualization of rhythm and meter theory in the context of microtime and groove concepts,

➢ To address changes in form understanding and loop-based structures,

➤   To discuss the repositioning of timbre, sound design, and mix as theoretical categories,

➤   To provide recommendations for music theory education.

Scope and Limitations of the Study

This systematic literature review does not merely describe existing approaches; rather than completely abandoning traditional music theory tools or directly adapting them, it advocates as an original argument the necessity of a hybrid analytical model enriched with timbral and spatial parameters. This model presents a new theoretical framework capable of grasping the digital production uniqueness of popular music by integrating functional harmony with 'timbral harmony,' rhythm theory with 'spatial groove,' and form analysis with 'mix topology.' The article constructs this argument through both literature synthesis and current analyses.

While this study compiles existing knowledge through a systematic literature review method, it employs targeted case analyses (The Weeknd, Billie Eilish, Calvin Harris) to substantiate and support its central theoretical argument. These case analyses contain analytical interpretations that apply theoretical concepts from the literature to concrete musical examples. The scope of the study is limited to pop, rock, hip-hop, R&B, EDM, and related genres. Areas such as jazz and experimental electronic music are addressed only insofar as they directly relate to popular music productions. The research focuses on academic journal articles, book chapters, doctoral and master's theses, and conference proceedings. Music theory textbooks, production guides, and commercial publications are excluded. A time constraint of 2000-2025 is established because the proliferation of DAW-based production practices occurred during this period. The case analyses of The Weeknd, Billie Eilish, and Calvin Harris serve as illustrative examples to demonstrate theoretical concepts rather than constituting primary empirical research.

This study has several limitations that should be acknowledged. First, the systematic review relies primarily on English-language publications, potentially excluding relevant non-English scholarship. Second, while the study provides case analyses of specific artists, these examples are illustrative rather than based on primary empirical research such as producer interviews or DAW session file analysis. Third, the rapid pace of technological change in music production means that some production practices and software capabilities may have evolved beyond what is captured in the reviewed literature. Finally, the study's focus on popular music genres (pop, rock, hip-hop, EDM) means that findings may not fully apply to other contemporary genres such as jazz or experimental electronic music.

Structure of the Article

Following the introduction, the study is structured as follows: The second section explains the systematic literature review methodology. The third section addresses the general literature and fundamental methodological debates concerning the relationship between traditional music theory and popular music. The fourth section examines transformations in the field of harmony and counterpoint; the fifth section addresses reconceptualizations in the field of rhythm and meter; the sixth section examines changes in form understanding; and the seventh section investigates the treatment of timbre, sound design, and mix as theoretical categories. The eighth section synthesizes the findings obtained from the literature and provides recommendations for music theory education.

Methodology

This study was conducted using a systematic literature review approach. The systematic literature review approach is defined as a comprehensive, transparent, and replicable evidence synthesis process focusing on a specific research question (Petticrew & Roberts, 2006, p. 19).

Data Sources and Search Strategy

The literature search was conducted through three primary academic databases: JSTOR (Journal Storage: access to academic journals in arts, humanities, and social sciences), RILM (Répertoire International de Littérature Musicale: the most comprehensive bibliographic database in musicology), and Google Scholar. These databases provide access to current and prestigious publications in the fields of music theory, musicology, and popular music studies.

The search strategy was developed using English keyword combinations. The primary search terms are: 'music theory,' 'popular music,' 'pop music,' 'rock music,' 'hip-hop,' 'EDM,' 'electronic dance music,' 'DAW,' 'digital audio workstation,'

'production,' 'mixing,' 'harmony,' 'rhythm,' 'groove,' 'form,' 'timbre,' 'sound design,' 'sampling,' 'loop-based composition,' 'microtime,' and various combinations of these terms. The search covers publications from 2000 to 2025. The study selection process was documented using a PRISMA 2020–style flow diagram to transparently report identification, screening, eligibility assessment, and inclusion decisions. Records retrieved from JSTOR, RILM, and Google Scholar were exported and deduplicated prior to screening. Titles and abstracts were screened against the predefined inclusion/exclusion criteria. Potentially relevant reports were then assessed in full text. Reasons for full-text exclusions (e.g., out of scope, not DAW/production-related, not peer-reviewed/eligible publication type, full text not accessible, outside 2000–2025) were recorded. The full identification-to-inclusion process and counts at each stage are summarized in Table 1 and Figure 1

Table 1. Summary of search strategy and retrieved records

| Database	Date searched	Search fields	Search string (core terms)	Limits/filters	Records retrieved (n)
JSTOR	10 May 2025	Title/Abstract/Full text	("music theory" AND "popular music") AND (DAW OR "digital audio workstation" OR production OR mixing OR "sound design")	2000-2025; English; scholarly/peer-reviewed	214
RILM	12 May 2025	Title/Abstract/Descriptors	(popular music AND music theory) AND (groove OR microtiming OR timbre OR sampling OR loop*) AND (production OR DAW)	2000-2025; English; scholarly items	167
Google Scholar	15 May 2025	All fields	("digital audio workstation" OR DAW) AND ("popular music" OR pop OR rock OR hip-hop OR EDM) AND (groove OR microtiming OR timbre OR "mixing")	2000-2025; exclude patents/citations (optional)	489
Total					870
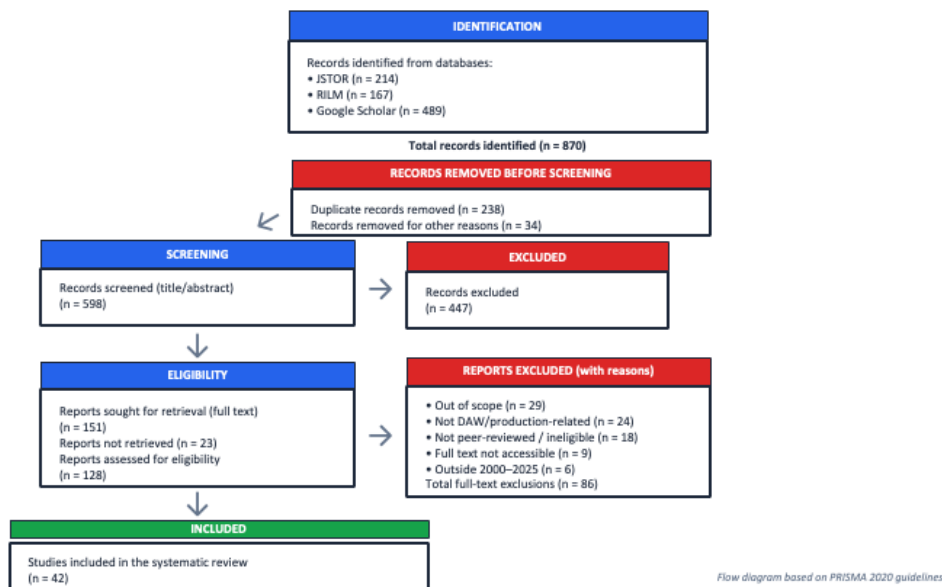
Figure 1. PRISMA-style flow diagram

Inclusion and Exclusion Criteria

Specific inclusion and exclusion criteria were applied in the literature search. Inclusion criteria:

➢ Studies examining how traditional music theory concepts transform in the context of popular music,

➢ Studies addressing the effects of DAW-based production practices on music theory,

➢ Articles published in peer-reviewed academic journals, book chapters from reputable publishers, doctoral and master's theses from accredited universities,

➢ Studies containing analytical examination of popular music genres (pop, rock, hip-hop, R&B, EDM).

Exclusion criteria:

➢ Studies focusing solely on jazz or experimental electronic music (unless their relationship to popular music is clear),

➢ Textbooks and production guides,

➢ Publications for which full text is not accessible,

➢ Publications that have not undergone peer review.

Data Analysis and Synthesis

The collected sources were examined using thematic analysis. For each conceptual category (harmony, counterpoint, rhythm, form, timbre), transformations, new concepts, and analytical approaches proposed in the literature were systematically recorded. Methodological differences among sources (adaptation of classical tools vs. development of new models) were identified and these differences were discussed. The study adopted a descriptive and critical synthesis approach: fundamental arguments in the literature were summarized, different approaches were compared, and research gaps were identified.

Results

Literature on the Relationship Between Traditional Music Theory and Popular Music

The relationship between traditional music theory and popular music has been a long-debated topic in the music theory and musicology disciplines. These debates are fundamentally shaped around three different methodological positions: adaptation of classical theoretical tools to popular music, development of new models based on production practices, and hybrid approaches combining these two.

Adaptation of Classical Theoretical Tools

The first methodological position argues that classical music theory tools can be adapted to the popular music repertoire. Researchers adopting this approach propose that traditional concepts such as Schenkerian analysis (an analytical method developed by Heinrich Schenker that reveals the fundamental structural layers of music), functional harmony, and voice-leading rules can be adapted to account for guitar/keyboard idioms and unnotated features.

For example, Duinker (2019, paragraphs 12-18), when analyzing chord loops (recurring chord sequences) frequently encountered in pop music, maintains traditional tonal concepts but expands these concepts by proposing new terms such as 'hybrid tonic' (an ambiguous center alternating between two tonic functions). Proponents of this approach emphasize that traditional theory offers a universal analytical framework and that popular music also contains fundamental musical parameters such as tonality, harmony, and form.

New Models Based on Production Practices

The second methodological position argues that popular music's production techniques, sampling, and recording practices require new models that emphasize process, medium, and technology rather than notation-based paradigms alone. Danielsen (2016, pp. 85-110) proposes that musical rhythm in the age of digital reproduction cannot be explained solely by notation-based meter and pulse concepts; instead, waveform analysis, DAW examination, and analysis of producer discourses must be incorporated into the analytical process.

This approach advocates a 'practice-first' analysis of popular music. Methods such as producer interviews, examination of DAW session files, and spectral analysis of audio recordings should be used alongside or instead of notation-based transcription. Von Appen et al. (2016, pp. 100-125) emphasize that in interpreting 21st-century pop music, the physical and technological characteristics of recorded sound must be centralized. This production-oriented approach can be further deepened with a software studies perspective. Manovich (2013, pp. 40-65) emphasizes that software is not merely a 'tool'; rather, it is a 'cultural actor' that actively shapes the user's thinking and creation methods. DAW interfaces transform how musicians conceptualize music by representing musical material as 'tracks,' 'clips,' and 'parameter automation curves.' Fuller (2008, pp. 15-30) explains this transformation through the concept of 'software as ideology': DAWs universalize this production logic by 'naturalizing' loop-based composition, layered thinking, and

parametric manipulation. This perspective demonstrates that popular music theory must also consider the epistemological effects of DAW interfaces. Not only the question 'What is being done in the DAW?' but also 'How does the DAW shape musical thought?' must be incorporated into theoretical analysis.

Hybrid Approaches and Practical Challenges

The third methodological position proposes combining classical theoretical tools with production-oriented methods. This approach argues that completely abandoning traditional concepts is unnecessary; however, these concepts must be expanded and reinterpreted to account for the unique practices of popular music. From a practical application perspective, this hybrid approach presents certain challenges. First, access to DAW session files is not always possible; for most commercial recordings, only the final mix is available. Second, the reliability of producer and artist discourses can be questioned; musicians do not always make conscious theoretical decisions, often acting with intuitive and practical priorities.

Transformations in the Fields of Harmony and Counterpoint

In traditional music theory, harmony is addressed within the framework of functional tonality. Tonic, dominant, and subdominant functions, cadences, and modulations are the fundamental tools of classical harmonic analysis. Counterpoint examines voice-leading rules and inter-voice relationships in polyphonic writing. However, in popular music productions, these concepts undergo significant transformations.

Cyclical and Static Harmonic Structures

In popular music, particularly in post-2000 productions, cyclical chord structures (chord loops) have become widespread. Duinker (2019, paragraphs 20-28) terms these structures as 'plateau loops' and notes that, unlike traditional functional harmony, a fixed loop revolves around a tonal center. For example, the I-V-vi-IV sequence (in C major: C-G-Am-F) is extremely common in pop music, and this loop creates a continuously repeating cycle rather than resolving the tonic-dominant progression in the classical sense.

Modal Ambiguity and Hybrid Tonics

In many pop songs, ambiguity between major and minor modes is observed. Duinker's concept of 'hybrid tonic' attempts to explain this ambiguity. For example, a song may alternate between C major and A minor; the tonic function is not fixed to a single chord. This situation is rarely seen in classical tonal analysis but is a frequently encountered phenomenon in popular music.

This modal ambiguity is part of a broader phenomenon in popular music called 'tonal ambiguity.' For instance, the I-♭VII-♭VI-♭VII (Aeolian modal interchange) progression, which became widespread in EDM and pop music throughout the 2010s, contains parallel fifths and a ♭VII-I cadence that could be considered an 'error' in classical tonal theory. However, this progression is perceived as an extremely natural and acceptable sound in popular music. Richards (2017, pp. 88-95) documents that such modal borrowing techniques have become increasingly common in pop harmony from 1960s rock music to the present.

Case Analysis: The Weeknd – Blinding Lights (2019)

The Weeknd's 'Blinding Lights' is a striking example of cyclical harmonic structure. The entire song is built upon the Fm-Eb-Bb-Db chord loop. This loop never changes from intro to outro; only the vocal melody and production layers change. In traditional functional harmonic analysis, finding a clear tonic-dominant relationship in this loop is difficult. Although the Fm chord appears to be the tonal center, the loop is in constant motion and there is no prolonged rest on any chord. From a production perspective, chord changes are emphasized by synthesizer arpeggios; each chord change is also perceived as a timbral change. This example demonstrates that harmonic analysis must be integrated with production analysis.

When examined more deeply from a production perspective, the harmonic structure of 'Blinding Lights' forms an inseparable whole with synthesizer timbres. The song's characteristic arpeggio sound is created using an emulation of the Roland Juno-106 synthesizer. With each chord change, the timbral character of the arpeggio changes slightly; this allows chord changes to be perceived not only at the pitch level but also at the timbral level. The use of automation to control

filter cutoff and resonance parameters imparts a dynamic timbral development to a static chord loop. This observation supports the concept of 'timbral harmony' proposed by Sanden (2013, pp. 65-70): in popular music, harmony is constructed not only through pitch relationships but also through timbral transformations.

Reconceptualizations in the Fields of Rhythm and Meter

This analysis significantly expands the discussion of 'functional harmony' in the literature. While Duinker's (2019) concept of 'hybrid tonic' explains tonic ambiguity, it still offers a pitch-centered perspective. However, the 'Blinding Lights' example demonstrates that harmony is constructed not only through pitch relationships but also through timbral transformations. Sanden's (2013) concept of 'timbral harmony' is critical at this point: the combination of chord changes with filter cutoff and resonance automation transforms 'harmony' from a one-dimensional (pitch) category into a multi-dimensional (pitch + timbre + automation) category. This finding demonstrates that merely 'adapting' traditional harmony theory is insufficient; the theoretical definition of harmony needs to be expanded. Production parameters can no longer be addressed under the 'orchestration' category; they directly constitute the harmonic structure itself.

In traditional music theory, rhythm and meter are defined by concepts of measure, pulse, note values, and metronomic tempo. However, in digital production, particularly in hip-hop and EDM, the understanding of rhythm has been enriched with new concepts such as microtime, groove, and quantization aesthetics.

Microtime and the Concept of Groove

Danielsen (2016, pp. 120-145) emphasizes that musical rhythm in the age of digital reproduction cannot be fully explained by notation-based meter and pulse concepts. Instead, the concepts of microtime (time differences at the millisecond level) and groove (rhythmic pattern creating a specific feel) come to the forefront. Groove is not merely a notation-based rhythmic figure; it is also a perceptual whole created by subtle variations in sound intensity, timing deviations, and timbral variations.

Quantization Aesthetics

In DAWs, quantization is the process of aligning MIDI notes to a specific grid. However, perfect quantization often creates a mechanical feel. Therefore, many producers use humanize and swing settings to simulate the natural timing deviations of human performers. Brovig-Hanssen et al. (2021, pp. 278-285) propose the concept of a flexible grid in EDM.

Case Analysis: Billie Eilish – Bad Guy (2019)

Billie Eilish's 'Bad Guy' is a striking example of minimal and microtime-focused rhythmic understanding. The song's fundamental groove is built upon very few sound elements: a bass sound, finger snaps, and minimal electronic beats. However, within this minimal structure, the timing and velocity of each sound are adjusted with extreme precision. The bass sound's slight deviation from the grid creates a lazy feel; the finger snap, standing precisely on the grid, creates a contrast. DAW analysis reveals that this groove is not completely quantized; rather, it is constructed with selective humanization. Traditional notation cannot display these subtle timing differences. This example reveals that groove analysis requires digital tools such as DAW visualization and waveform examination.

Disciplinary Consequences of These Reconceptualizations

These transformations in the field of rhythm and meter question one of music theory's fundamental tools—notation. Traditional notation represents rhythms with discrete symbols (♩, ♪, ♫) and cannot display timing differences at the millisecond level. This reveals the limitation of notation transcription in popular music analysis. DAWs' waveform and MIDI views have become the new 'notation' of rhythmic analysis. However, this is not merely a technical change; it is also an indicator of an epistemological shift. Music theory is evolving from a discipline centered on the 'written work' to one centered on 'recorded sound.' The deepest consequence of this shift is: 'Musical knowledge' now resides not in the score but in the audio file. This necessitates the addition of new skills such as 'spectral listening' and 'DAW analysis' alongside traditional practices like 'solfège' and 'dictation' in music theory education.

This microtime-focused approach in the field of rhythm and groove does not operate solely at the beat level. Groove also affects larger-scale formal structure. The addition/removal of layers and the management of the energy profile are

the reflection of rhythmic groove at the formal level. This connection is critical for understanding the transformations in form theory to be discussed in the next section.

Changes in Form Understanding

This analysis fills an important gap by expanding Danielsen's (2016) concept of 'microtime': the role of silence and spatial space as a formal element in minimal production. While Danielsen addresses microtime through 'timing deviations,' the 'Bad Guy' example demonstrates that what is NOT played is as critical as microtime. The song's groove comes from the spaces between the bass and finger snaps. These spaces could be viewed as a 'deficiency' in traditional form theory; however, in minimal EDM and trap music, these spaces construct form. Zagorski-Thomas's (2014) concept of 'spectral space' gains new meaning here: space is a structural category not only in the frequency spectrum but also in the time spectrum. This finding reveals that rhythm theory must analyze not only 'beats' but also 'spaces between beats.'

In traditional music theory, form is built upon principles of thematic development, contrast, and repetition. In popular music, form is generally defined by a verse-chorus structure and section-based organization. However, in the digital production age, particularly in EDM and hip-hop, form understanding is shaped by new concepts such as loop-based structures, layering, and the drop.

Loop-Based Form and Layering

In EDM and hip-hop, rather than thematic development in the traditional sense, form is constructed through the addition and removal of loops. Sfetcu (2018, pp. 30-42), when examining EDM forms, proposes concepts such as reverse extension and embedded grouping dissonance. Layering is a fundamental component of formal structure. A single synth loop begins in an intro; drums and bass are added in the verse; additional melodic layers enter in the chorus; and all layers converge at maximum energy in the drop.

This loop-based form understanding is explained by Butler (2006, pp. 90-110) through the metaphor of 'unlocking the groove.' According to Butler, form in EDM is organized not around a linear narrative or thematic development but around the infinite repetition of loops and the trance-like experience this repetition creates in the listener. The addition of each new layer draws the listener into a deeper groove experience; the removal of layers creates a kind of 'sonic space' that allows for breathing.

In academic literature, various new concepts have been developed to analyze EDM forms. Sfetcu (2018, pp. 35-40) proposes the concept of 'tension-release cycles,' emphasizing that each build-up/drop pair creates a physiological tension-release cycle in the listener. Peres (2016, pp. 228-235) uses the term 'climax-oriented form' to explain that EDM tracks are organized around single or multiple climax points. These concepts radically differ from the exposition-development-recapitulation structure in classical form theory.

The Drop and Energy Management

In EDM, the drop is the most critical moment of form. Typically following a build-up section, the drop is the moment when energy reaches its maximum, when bass and drum sounds are most intense. Le (2022, pp. 48-52) explains the drop through the concept of topological space: the drop can be conceived as a spatial point where the density of musical material reaches its peak.

Case Analysis: Calvin Harris – Summer (2014)

Calvin Harris's 'Summer' is a typical example of EDM formal structure. The song consists of the following sections: Intro (16 bars, minimal synth loop), Verse 1 (16 bars, vocal + synth), Pre-Chorus (8 bars, build-up), Chorus/Drop 1 (16 bars, maximum energy), Breakdown (16 bars), Verse 2 (16 bars), Pre-Chorus 2 (8 bars), Chorus/Drop 2 (32 bars, extended drop), Outro (16 bars). In this structure, there is no theme in the traditional sense; only the vocal melody and synth riff repeat. The formal structure is constructed through the addition/removal of layers and the management of energy level. Drop moments are defined by the density of bass frequencies, the complexity of drum patterns, and the number of synth layers.

This analysis proposes a new synthesis by bringing together Sfetcu's (2018) concept of 'reverse extension' and Le's (2022) concept of 'topological space': 'mix topology.' Traditional form theory treats form as a temporal category

(sequential structures like A-B-A). However, the 'Summer' example demonstrates that form in EDM is also a spatial/topological category. Drop moments are perceived not only as 'a point in time' but also as 'a space where the frequency spectrum intensifies.' This reveals that mix cannot be addressed solely under the 'timbre' category; mix directly constitutes formal structure. Filter opening during the build-up functions not merely as a 'timbral change' but as a formal 'transition.' This finding requires a new conceptual framework that eliminates the rigid distinction between 'form' and 'timbre' in music theory, integrating these two categories: 'Timbral form.'

The Ontological Shift in Form Theory

These transformations in the field of form raise the fundamental ontological question of what 'form' is. In classical theory, form is defined as 'the temporal organization of thematic content.' However, in EDM, there is no theme; there are only repeating loops and layers. In this case, the question of what defines form becomes critical. This literature review's analysis demonstrates that form in EDM operates in three dimensions: (1) Temporal dimension (sequence of sections), (2) Vertical/spectral dimension (addition/removal of layers), (3) Energy dimension (density profile). This multi-dimensional form understanding parallels Cook's (2013) 'performance-centered' musicology approach: form exists not in 'the written score' but in 'the realized sonic event.' In music theory education, when teaching sonata form or rondo, it should be emphasized that these forms are valid only for a specific repertoire (18th-19th century European classical music); in EDM, however, an entirely different formal logic operates.

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Hybrid Approaches and Practical Challenges

The third methodological position proposes combining classical theoretical tools with production-oriented methods. This approach argues that completely abandoning traditional concepts is unnecessary; however, these concepts must be expanded and reinterpreted to account for the unique practices of popular music. From a practical application perspective, this hybrid approach presents certain challenges. First, access to DAW session files is not always possible; for most commercial recordings, only the final mix is available. Second, the reliability of producer and artist discourses can be questioned; musicians do not always make conscious theoretical decisions, often acting with intuitive and practical priorities.

Transformations in the Fields of Harmony and Counterpoint

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Cyclical and Static Harmonic Structures

In popular music, particularly in post-2000 productions, cyclical chord structures (chord loops) have become widespread. Duinker (2019, paragraphs 20-28) terms these structures as 'plateau loops' and notes that, unlike traditional functional harmony, a fixed loop revolves around a tonal center. For example, the I-V-vi-IV sequence (in C major: C-G-Am-F) is extremely common in pop music, and this loop creates a continuously repeating cycle rather than resolving the tonic-dominant progression in the classical sense.

Modal Ambiguity and Hybrid Tonics

In many pop songs, ambiguity between major and minor modes is observed. Duinker's concept of 'hybrid tonic' attempts to explain this ambiguity. For example, a song may alternate between C major and A minor; the tonic function is not fixed to a single chord. This situation is rarely seen in classical tonal analysis but is a frequently encountered phenomenon in popular music.

This modal ambiguity is part of a broader phenomenon in popular music called 'tonal ambiguity.' For instance, the I-♭VII-♭VI-♭VII (Aeolian modal interchange) progression, which became widespread in EDM and pop music throughout the 2010s, contains parallel fifths and a ♭VII-I cadence that could be considered an 'error' in classical tonal theory. However, this progression is perceived as an extremely natural and acceptable sound in popular music. Richards (2017, pp. 88-95) documents that such modal borrowing techniques have become increasingly common in pop harmony from 1960s rock music to the present.

Case Analysis: The Weeknd – Blinding Lights (2019)

The Weeknd's 'Blinding Lights' is a striking example of cyclical harmonic structure. The entire song is built upon the Fm-Eb-Bb-Db chord loop. This loop never changes from intro to outro; only the vocal melody and production layers change. In traditional functional harmonic analysis, finding a clear tonic-dominant relationship in this loop is difficult. Although the Fm chord appears to be the tonal center, the loop is in constant motion and there is no prolonged rest on any chord. From a production perspective, chord changes are emphasized by synthesizer arpeggios; each chord change is also perceived as a timbral change. This example demonstrates that harmonic analysis must be integrated with production analysis.

When examined more deeply from a production perspective, the harmonic structure of 'Blinding Lights' forms an inseparable whole with synthesizer timbres. The song's characteristic arpeggio sound is created using an emulation of the Roland Juno-106 synthesizer. With each chord change, the timbral character of the arpeggio changes slightly; this allows chord changes to be perceived not only at the pitch level but also at the timbral level. The use of automation to control

filter cutoff and resonance parameters imparts a dynamic timbral development to a static chord loop. This observation supports the concept of 'timbral harmony' proposed by Sanden (2013, pp. 65-70): in popular music, harmony is constructed not only through pitch relationships but also through timbral transformations.

Reconceptualizations in the Fields of Rhythm and Meter

This analysis significantly expands the discussion of 'functional harmony' in the literature. While Duinker's (2019) concept of 'hybrid tonic' explains tonic ambiguity, it still offers a pitch-centered perspective. However, the 'Blinding Lights' example demonstrates that harmony is constructed not only through pitch relationships but also through timbral transformations. Sanden's (2013) concept of 'timbral harmony' is critical at this point: the combination of chord changes with filter cutoff and resonance automation transforms 'harmony' from a one-dimensional (pitch) category into a multi-dimensional (pitch + timbre + automation) category. This finding demonstrates that merely 'adapting' traditional harmony theory is insufficient; the theoretical definition of harmony needs to be expanded. Production parameters can no longer be addressed under the 'orchestration' category; they directly constitute the harmonic structure itself.

In traditional music theory, rhythm and meter are defined by concepts of measure, pulse, note values, and metronomic tempo. However, in digital production, particularly in hip-hop and EDM, the understanding of rhythm has been enriched with new concepts such as microtime, groove, and quantization aesthetics.

Microtime and the Concept of Groove

Danielsen (2016, pp. 120-145) emphasizes that musical rhythm in the age of digital reproduction cannot be fully explained by notation-based meter and pulse concepts. Instead, the concepts of microtime (time differences at the millisecond level) and groove (rhythmic pattern creating a specific feel) come to the forefront. Groove is not merely a notation-based rhythmic figure; it is also a perceptual whole created by subtle variations in sound intensity, timing deviations, and timbral variations.

Quantization Aesthetics

In DAWs, quantization is the process of aligning MIDI notes to a specific grid. However, perfect quantization often creates a mechanical feel. Therefore, many producers use humanize and swing settings to simulate the natural timing deviations of human performers. Brovig-Hanssen et al. (2021, pp. 278-285) propose the concept of a flexible grid in EDM.

Case Analysis: Billie Eilish – Bad Guy (2019)

Billie Eilish's 'Bad Guy' is a striking example of minimal and microtime-focused rhythmic understanding. The song's fundamental groove is built upon very few sound elements: a bass sound, finger snaps, and minimal electronic beats. However, within this minimal structure, the timing and velocity of each sound are adjusted with extreme precision. The bass sound's slight deviation from the grid creates a lazy feel; the finger snap, standing precisely on the grid, creates a contrast. DAW analysis reveals that this groove is not completely quantized; rather, it is constructed with selective humanization. Traditional notation cannot display these subtle timing differences. This example reveals that groove analysis requires digital tools such as DAW visualization and waveform examination.

Disciplinary Consequences of These Reconceptualizations

These transformations in the field of rhythm and meter question one of music theory's fundamental tools—notation. Traditional notation represents rhythms with discrete symbols (♩, ♪, ♫) and cannot display timing differences at the millisecond level. This reveals the limitation of notation transcription in popular music analysis. DAWs' waveform and MIDI views have become the new 'notation' of rhythmic analysis. However, this is not merely a technical change; it is also an indicator of an epistemological shift. Music theory is evolving from a discipline centered on the 'written work' to one centered on 'recorded sound.' The deepest consequence of this shift is: 'Musical knowledge' now resides not in the score but in the audio file. This necessitates the addition of new skills such as 'spectral listening' and 'DAW analysis' alongside traditional practices like 'solfège' and 'dictation' in music theory education.

This microtime-focused approach in the field of rhythm and groove does not operate solely at the beat level. Groove also affects larger-scale formal structure. The addition/removal of layers and the management of the energy profile are

the reflection of rhythmic groove at the formal level. This connection is critical for understanding the transformations in form theory to be discussed in the next section.

Changes in Form Understanding

This analysis fills an important gap by expanding Danielsen's (2016) concept of 'microtime': the role of silence and spatial space as a formal element in minimal production. While Danielsen addresses microtime through 'timing deviations,' the 'Bad Guy' example demonstrates that what is NOT played is as critical as microtime. The song's groove comes from the spaces between the bass and finger snaps. These spaces could be viewed as a 'deficiency' in traditional form theory; however, in minimal EDM and trap music, these spaces construct form. Zagorski-Thomas's (2014) concept of 'spectral space' gains new meaning here: space is a structural category not only in the frequency spectrum but also in the time spectrum. This finding reveals that rhythm theory must analyze not only 'beats' but also 'spaces between beats.'

In traditional music theory, form is built upon principles of thematic development, contrast, and repetition. In popular music, form is generally defined by a verse-chorus structure and section-based organization. However, in the digital production age, particularly in EDM and hip-hop, form understanding is shaped by new concepts such as loop-based structures, layering, and the drop.

Loop-Based Form and Layering

In EDM and hip-hop, rather than thematic development in the traditional sense, form is constructed through the addition and removal of loops. Sfetcu (2018, pp. 30-42), when examining EDM forms, proposes concepts such as reverse extension and embedded grouping dissonance. Layering is a fundamental component of formal structure. A single synth loop begins in an intro; drums and bass are added in the verse; additional melodic layers enter in the chorus; and all layers converge at maximum energy in the drop.

This loop-based form understanding is explained by Butler (2006, pp. 90-110) through the metaphor of 'unlocking the groove.' According to Butler, form in EDM is organized not around a linear narrative or thematic development but around the infinite repetition of loops and the trance-like experience this repetition creates in the listener. The addition of each new layer draws the listener into a deeper groove experience; the removal of layers creates a kind of 'sonic space' that allows for breathing.

In academic literature, various new concepts have been developed to analyze EDM forms. Sfetcu (2018, pp. 35-40) proposes the concept of 'tension-release cycles,' emphasizing that each build-up/drop pair creates a physiological tension-release cycle in the listener. Peres (2016, pp. 228-235) uses the term 'climax-oriented form' to explain that EDM tracks are organized around single or multiple climax points. These concepts radically differ from the exposition-development-recapitulation structure in classical form theory.

The Drop and Energy Management

In EDM, the drop is the most critical moment of form. Typically following a build-up section, the drop is the moment when energy reaches its maximum, when bass and drum sounds are most intense. Le (2022, pp. 48-52) explains the drop through the concept of topological space: the drop can be conceived as a spatial point where the density of musical material reaches its peak.

Case Analysis: Calvin Harris – Summer (2014)

Calvin Harris's 'Summer' is a typical example of EDM formal structure. The song consists of the following sections: Intro (16 bars, minimal synth loop), Verse 1 (16 bars, vocal + synth), Pre-Chorus (8 bars, build-up), Chorus/Drop 1 (16 bars, maximum energy), Breakdown (16 bars), Verse 2 (16 bars), Pre-Chorus 2 (8 bars), Chorus/Drop 2 (32 bars, extended drop), Outro (16 bars). In this structure, there is no theme in the traditional sense; only the vocal melody and synth riff repeat. The formal structure is constructed through the addition/removal of layers and the management of energy level. Drop moments are defined by the density of bass frequencies, the complexity of drum patterns, and the number of synth layers.

This analysis proposes a new synthesis by bringing together Sfetcu's (2018) concept of 'reverse extension' and Le's (2022) concept of 'topological space': 'mix topology.' Traditional form theory treats form as a temporal category

(sequential structures like A-B-A). However, the 'Summer' example demonstrates that form in EDM is also a spatial/topological category. Drop moments are perceived not only as 'a point in time' but also as 'a space where the frequency spectrum intensifies.' This reveals that mix cannot be addressed solely under the 'timbre' category; mix directly constitutes formal structure. Filter opening during the build-up functions not merely as a 'timbral change' but as a formal 'transition.' This finding requires a new conceptual framework that eliminates the rigid distinction between 'form' and 'timbre' in music theory, integrating these two categories: 'Timbral form.'

The Ontological Shift in Form Theory

These transformations in the field of form raise the fundamental ontological question of what 'form' is. In classical theory, form is defined as 'the temporal organization of thematic content.' However, in EDM, there is no theme; there are only repeating loops and layers. In this case, the question of what defines form becomes critical. This literature review's analysis demonstrates that form in EDM operates in three dimensions: (1) Temporal dimension (sequence of sections), (2) Vertical/spectral dimension (addition/removal of layers), (3) Energy dimension (density profile). This multi-dimensional form understanding parallels Cook's (2013) 'performance-centered' musicology approach: form exists not in 'the written score' but in 'the realized sonic event.' In music theory education, when teaching sonata form or rondo, it should be emphasized that these forms are valid only for a specific repertoire (18th-19th century European classical music); in EDM, however, an entirely different formal logic operates.

Conclusion and Discussion

This final section brings together the conceptual transformations discussed in the previous four analytical sections (Harmony, Rhythm, Form, Timbre/mix) to formulate the article's central argument. In Section 4, we saw that harmony has become an integrated category of pitch + timbre + automation; in Section 5, that rhythm is defined by microtime and spatial spaces; in Section 6, that form is constructed through timbral transformations. These three observations converge at a common point: Timbre and mix are no longer a secondary parameter but a fundamental analytical dimension that shapes all theoretical categories. This synthesis proposes a fourth path beyond the three methodological approaches in the literature (adaptation of classical tools, development of new models, hybrid approach): the timbre-centered hybrid paradigm.

The conceptual transformations examined in previous sections (cyclical harmony, microtime, layering) converge at a common point: the fact that timbre and mix have become too central to be addressed solely under the 'orchestration' category. This section constructs the article's main argument: In popular music, timbre and mix are no longer a secondary parameter but a fundamental analytical dimension that shapes all theoretical categories from harmony to form, from rhythm to counterpoint. This synthesis proposes a fourth path beyond the three methodological approaches in the literature (adaptation, new model, hybrid): the timbre-centered hybrid model.

Traditional orchestration theory examines the timbral characteristics of instrument families, register usage, and how instruments blend together. However, in popular music production, timbre is not merely instrument selection; it is also a product of sound design and mixing processes.

Track Identity and Sound Design

In DAW-based production, each track has its own identity. A bass track is defined not only by bass notes but also by the synth preset used, filter settings, distortion amount, and reverb character. This track identity is a concept without correspondence in traditional orchestration theory.

Mix Aesthetics and the Structural Role of Timbre

In popular music, mixing is not merely a technical finishing process; it is also a compositional decision. Decisions about which tracks will be in the foreground, which in the background, and how tightly bass and drums will integrate directly affect the perception of musical structure. Side-chain compression (one sound temporarily silencing other sounds), as a technique where timbre and rhythm merge, becomes part of the formal structure. Brovig-Hanssen et al. (2021, pp. 288-290) argue that mix should be treated as an aesthetic category.

Theoretical Foundations of the Timbre-Centered Model

The fundamental argument of this article is that in popular music analysis, timbre and mix must be elevated to a status equal to (and in some cases prioritized over) traditional theoretical categories. This argument is based on three fundamental observations:

First, as the analyses demonstrate, harmony can no longer be defined solely by pitch relationships. In the 'Blinding Lights' example, chord changes form an inseparable whole with timbral automations. This validates and expands Sanden's (2013) concept of 'timbral harmony': harmony is an integrated category of pitch + timbre + automation.

Second, rhythm and groove can be grasped not only through notation but through waveform analysis. In the 'Bad Guy' example, the microtime differences and spatial spaces that constitute the groove are outside traditional notation. This supports Danielsen's (2016) microtime concept and combines it with Zagorski-Thomas's (2014) spectral space concept.

Third, form is now constructed not only through thematic development but through timbral transformations. In the 'Summer' example, build-ups and drops occur through timbral changes (filter opening, layer addition). This validates Le's (2022) topological space concept and necessitates the 'timbral form' concept.

These three observations allow us to reach the following conclusion: In popular music, timbre and mix are no longer a 'sub-category' but the analytical center.

Analytical Application of the Timbre-Centered Model

This model proposes the following practical steps in popular music analysis: (1) Multi-layered listening: Analysis should be conducted not only with the stereo mix but, when possible, with DAW session files. Listening to each track separately reveals the structural importance of timbral decisions. (2) Spectral visualization: Waveform and spectrogram views display timbral and temporal details that notation cannot capture. This should be a fundamental part of the analytical process, not merely an 'auxiliary tool.' (3) Parametric mapping: Automation of production parameters such as filters, EQ, and compressors should be mapped for formal analysis. A filter opening is as significant a formal event as a 'modulation' in traditional form theory. (4) Integrated transcription: Notation transcription should be done if possible but should not be considered sufficient alone. Timbral parameters, mixing decisions, and spectral information must be added to notation.

The literature review reveals four fundamental conceptual transformations. First is the shift from functional tonality to cyclical and static structures in harmony. Traditional tonic-dominant-subdominant relationships are being replaced in popular music by new concepts such as plateau loops and hybrid tonics. Researchers such as Duinker (2019) and Exarchos (2020) have systematically documented this transformation and proposed new analytical terms.

Second is the shift in rhythm from meter and pulse theory to microtime and groove concepts. Danielsen's (2016) work demonstrates that traditional notation-based rhythm analysis cannot capture the subtle timing differences of digital production. DAW-based concepts such as quantization aesthetics, humanization, and swing have become new tools of rhythm theory.

Third is the transformation in form from thematic development to layering and energy management. Researchers such as Sfetcu (2018) and Le (2022) have emphasized that formal techniques in EDM such as drop, build-up, and reverse extension require new analytical categories without correspondence in classical form theory.

Fourth is the shift in the field of timbre and orchestration from instrument families to sound design and mix aesthetics. Track identity, side-chain compression, and the treatment of mix as a compositional category have become central in popular music analysis.

Recommendations

Methodological Debates and Practical Challenges

Three fundamental methodological positions are identified in the literature: adaptation of classical theoretical tools, development of new models based on production practices, and hybrid approaches. The ongoing debate among these three positions questions the epistemological foundations of the music theory discipline. The approach of adapting

classical tools is criticized for its universality claim; production-oriented new models are accused of ignoring traditional theoretical knowledge.

Practical challenges include: limited access to DAW session files, reliability issues with producer discourses, the technical gap between notation-based transcription and waveform analysis, and music theory educators' lack of digital production knowledge. To overcome these challenges, interdisciplinary collaborations (music theory, music technology, audio engineering) and integration of DAW literacy into music theory curricula are necessary.

Recommendations for Music Theory Education and Pedagogy

The findings of this literature review offer important implications for music theory education. Traditional music theory curricula typically focus on Western art music repertoire and emphasize notation-based analytical methods. However, today most students are consumers and/or producers of popular music. Therefore, music theory education must be expanded to include popular music practices.

In terms of curriculum design, by incorporating DAW literacy, critical listening oriented toward production techniques, and practice-based projects, students should learn analysis based on recorded sound production (Bontempi et al., 2023, pp. 12-15; Reuter, 2021, pp. 16-18). For example, students could open a pop song in a DAW, examine each track separately, observe effect automations, and analyze how production decisions shape musical structure.

In terms of computational and perceptual studies, encouraging interdisciplinary work combining Music Information Retrieval (MIR: technologies for extracting musical information from digital audio recordings), controlled listening experiments, and ethnographic producer studies is recommended (Agres et al., 2017, pp. 14-16). For instance, studies empirically testing the effects of different groove templates on listener perception, or research examining how timbral changes affect formal section perception, can operationalize new analytical categories.

Recommendations for Future Research

Future research should pursue empirical investigations including:

➢ Psychoacoustic studies examining listener perception of microtime deviations and groove intensity across different genres

➢ Systematic analysis of DAW session files from professional productions to document actual production workflows and decision-making processes

➢ Comparative studies of music theory curriculum across institutions to assess integration of popular music concepts

➢ Development and validation of pedagogical materials for teaching DAW-based analysis methods

➢ Cross-genre studies examining whether theoretical transformations identified in pop/EDM apply to other contemporary styles.

Future research should include empirical testing of these new conceptual frameworks, their application to different genres and cultural contexts, and practical integration into music theory education. While remaining sensitive to genre conventions, production possibilities, and cultural practices, analytical studies centering popular music's unique practices should be encouraged rather than uncritically reflecting classical norms.

The following research areas are particularly prioritized:

➢ Empirical studies measuring the effects of different quantization aesthetic applications on listener perception,

➢ Experimental research examining how track identity and mix aesthetics affect formal perception,

➢ Case studies documenting how sampling practice transforms harmony and form understanding in genres such as hip-hop and trap,

➢ Large-scale corpus studies based on systematic analysis of DAW session files,

➢ Ethnographic examination of producer and artist discourses.

The Future of the Discipline: Toward a Timbre-Centered Paradigm

Evaluated collectively, the literature advocates a pluralistic and production-informed music theory that develops new concepts and methods adapted to contemporary popular music practices and materials while preserving classical insights (Danielsen, 2016; von Appen et al., 2016; Brovig-Hanssen et al., 2021; Bontempi et al., 2023; Reuter, 2021). Traditional

music theory concepts need not be completely abandoned; however, these concepts must be expanded and reinterpreted to account for popular music′s unique features such as digital production practices, loop-based composition, sampling, sound design, and mixing.

The timbre-centered model advocated by this article requires three fundamental transformations for the future of the music theory discipline:

First, epistemological transformation: Music theory must transition from a ′written work′-centered epistemology to a ′recorded sound′-centered epistemology. Born′s (2010) ′ontological pluralism′ and Cook′s (2013) ′performance-centered musicology′ approaches provide the theoretical foundation for this transition. Musical knowledge is now extracted not from scores but from audio files and DAW session files.

Second, methodological transformation: The tools of analysis must expand. Notation transcription, spectral analysis, DAW examination, and producer ethnography should be used together. Fuller and Manovich′s software studies perspective emphasizes that DAWs are not merely ′neutral tools′ but also ′cultural actors′ that shape musical thought. This makes critical analysis of DAWs part of the analytical process.

Third, pedagogical transformation: Music theory education should not focus solely on classical repertoire. DAW literacy, spectral analysis, timbral analysis, and mix aesthetics should be incorporated into the curriculum as fundamental skills alongside solfège and harmony. Sterne′s (2003) history of sound technologies perspective demonstrates that the historical and cultural context of these skills must also be taught.

These transformations will bring music theory into alignment with the dominant music practice of the 21st century. However, this is not a rejection of traditional theory; it is an expansion to encompass popular music′s unique practices. The timbre-centered model provides the analytical framework for this expansion.

This compilation emphasizes that the music theory discipline must evolve to encompass the dominant music production and consumption practices of the 21st century. The new conceptualizations and analytical approaches emerging in the fields of harmony, rhythm, form, and timbre will enable music theorists, educators, and researchers to understand and analyze popular music more deeply. This transformation is not merely an academic debate; it is a process of vital importance for the future of music production, criticism, and education.

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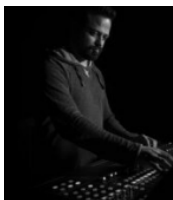
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