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Article

Innovative Processes in 20th-Century Music: from the Avant-Garde to the Digitization of Music

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Abstract

The musical art of the twentieth century is characterized by the rapid evolution of styles, genres, and expressive means, inspired by the development of technology, including in the field of sound recording and electronic musical instruments. The purpose of this paper is to provide a generalized overview of the innovations that appeared in music during the twentieth century and determined its stylistic diversity. The research methodology is based on an empirical approach that includes the analysis of musicological literature and the analysis of scores by composers from different countries who worked in different musical genres and made the greatest contribution to the introduction of the latest compositional techniques. It has been found that innovations in the music of the twentieth century affect the timbral palette and peculiarities of the pitch organization of the musical fabric. The renewal of timbral diversity is primarily associated with the development of electronic sound synthesis, which opens opportunities for generating sounds inaccessible to acoustic musical instruments. By the end of the twentieth century, special synthetic sounds became the basis of electronic dance music, such as techno and house. Innovative methods of pitch organization refer to composers' searches aimed at expanding or introducing alternatives to the classical tonal system. Such alternatives include modality, serial technique, and microintervals. These updates concern not only the author's material, but also the methods of composer's work with folk music - the combination of folk melodies with innovative harmonic and timbral solutions became the basis of neo-folklorism.

Keywords: *cultural discourse, digitalization, media, music education, musician training.*

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Introduction

Throughout the twentieth century, various art forms experienced a rapid renewal. The catalyst for these processes was scientific, technical, and technological progress, particularly the emergence of sound recording, video recording, and electronic computing. Music technologies, including recording equipment and new musical instruments, have "shaped the way music is created, performed, distributed, and consumed" (Lerch, 2017). The latest technological tools open the way to creating unattainable sounds, images, or video sequences with traditional means, thus expanding the artist's possibilities. Collaboration between science and art helps expand knowledge boundaries and fosters creativity (Nyakayo, 2025, p. 2).

It should also be noted that the numerous trends and events that occurred in music education during the second half of the twentieth century allowed the profession to remain a diverse and dynamic component of education, particularly in the United States, thanks in large part to the leadership of the Music Educators National Conference (Mark, 1999). The sharply increased dynamics of scientific and technological progress, urbanization as a cultural phenomenon that left its mark not only on architecture but also on people's lifestyle and artistic thinking, and extreme radicalism in the search for means of artistic expression led to a deliberate, emphasized break with tradition, as well as the interest of artists (musicians, painters, writers) in mythology, and on the other hand, in cosmology, in metaphysical principles, in themes related to space, all this together determined the genetic sources of avant-gardism, was reflected in its aesthetics, and led to a departure from excessive pedagogic conservatism in music education.

Musical art has an arsenal of expressive means related to sound pitch and timbre characteristics. And since music, unlike visual art, is temporal art (Stambaugh, 1964, p. 264), the peculiarities of the unfolding of sounds in time also play a significant role. These characteristics have also been influenced throughout the history of art, and this influence became especially noticeable with the development of technology in the early twentieth century. Social media and virtual reality (Fan, 2024, p. 25), which began to develop at the turn of the 20th to 21st century, also significantly expanded the scope of musical expressive means (Marynin, 2024).

Thus, our article aims to investigate which expressive means and forms of sound organization have become the latest in the twentieth century.

Literature review

Antokoletz (2014) claims that musical issues interwoven with political, cultural, and social conditions significantly impacted the vector of twentieth-century musical tendencies and styles. For instance, in the early 20th century, German late Romantic musical genres evolved into more focused artistic idioms of expression. This development coincided with, and was somewhat influenced by, emerging literary and psychological trends. Kalinowski et al. (2021) also discuss the evolutionary roots of music in the context of both classical and contemporary anthropological theories, including the Music and Social Bonding (MSB) theory. This theory holds that music is a fundamental aspect of human social existence and is closely related to its fundamental mechanisms. Indeed, disruptive breakthroughs in the field of music correlate with the chaotic political and social events of the 20th century.

An analysis of the literature of recent years shows the predominance of research on the use of computer technologies for the creation or analysis of musical material at the present stage. These studies can be divided into several areas: research on digital workstations (DAWs) designed to create music, analytical technologies for music information retrieval (MIR), and the possibilities of creating musical compositions by artificial intelligence.

Among the most recent DAW studies is Yang's (2024) work, which provides a comparative analysis of modern software - Apple Logic Pro X, Cubase 12, and Ableton Live Lite 11. The author notes that choosing a DAW is a difficult task for independent producers, as each has its advantages and disadvantages (Yang, 2024, p. 564).

Research on analytical programs has been of continuing interest over the past two decades. Among the most recent works is the research by Rentana WuYixiao Pan, which demonstrated the high performance of the newly developed derivative-free optimized refined random forest (DFO-RRF) technology, which allows to "assign a track to certain styles of electronic dance music based on timbral and metrical characteristics" (Wu & Pan, 2025, p. 1). In a similar study, Naidu et al. (2025) used convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to recognize music genres. Audio files were analyzed using Mel-spectrograms. According to the researchers, using machine learning in genre classification reflects a "broad shift" in the music industry (Naidu et al., 2025, p. 2). Some studies are devoted to attempts to apply analytical technologies to analyze folk music, including videos of ritual music from the West African Akan tribe (Moor et al., 2025) and recordings of Indian classical raga (Jayanthi & Upendran, 2025).

Music creation with the help of artificial intelligence is also one of the most relevant research areas. For example, Sampada (2025) investigates using deep learning

to generate Music in ABC notation format using recurrent neural networks (RNNs). The author proposes a system that learns from a large dataset of ABC notation, generates new musical compositions, and converts them to MIDI and WAV formats for easy playback.

Alessandra Corbelli (2024) raises ethical, aesthetic, and legal issues of using AI to create music. The author believes that AI can be "a powerful tool capable of supporting, assisting, and facilitating the work of the composer", but the shortcomings of AI [...] still "require the intervention of musicians, who are and will remain indispensable to give the musical object the status of a work of art" (Corbelli, 2024, p. 186).

The development of more traditional music, composed for symphony or vocal groups, has received relatively less attention from researchers, which is a sign of the vacuum being filled.

Methodology

The study is based predominantly on bibliographical research methods and content analysis. In order to identify innovations, the musicological literature on innovative compositional techniques and scores by composers from different countries who worked in different musical genres made the most significant contribution to the introduction of the latest compositional techniques, particularly P. Hindemith, A. Schoenberg, B. Liatoshynsky, O. Messiaen, K. Stockhausen, and W. Lutosławski, was studied. Particular attention is paid to such aspects as the tonal and atonal organization of the sound space, the use of micropolyphony, sonorous effects, aleatorics, electroacoustic elements, and other techniques that have become crucial in the music of the 20th to 21st centuries. The results obtained allow the systematization of the latest compositional techniques and the outlines of the main vectors of their further development, which is important for understanding contemporary musical language and the processes of its transformation.

Research design. The study uses a combined approach. This study is descriptive and involves the use of thematic research methods and secondary data analysis.

Research tools. The study used several general scientific methods, including bibliographical research methods and content analysis (to study contemporary theoretical concepts and scientific developments, clarify terminology, and systematize conceptual approaches).

Data analysis. Data analysis was performed using mixed methods of analysis.

Results

The fundamental musicological work that allows us to systematize and summarize the latest compositional techniques used in the first half to the middle of the twentieth century is Kohoutek's "Techniques of Composition in the Twentieth Century" (Kohoutek, 1965). The analysis of this book allows us to present the main innovations of this period in the following table (Table 1).

Table 1. Major innovations in music of the first half to mid-20th century

Innovation	**Composers**
Expansion of the tone system	B. Bartók, B. Britten, B. Liatoshynsky, B. Martinu, O. Messiaen, C. Debussy, J. Enescu, A. Onegger, F. Poulenc, M. Ravel, I. Stravinsky, K. Szymanowski, R. Strauss, P. Hindemith.
Modal system (artificial modes)	O. Messiaen, B. Bartók, B. Liatoshynskyi.
Micro intervals	A. Haba, C. Ives
Serial and serial technique	A. Schoenberg, A. Berg, A. Webern, P. Boulez, K. Stockhausen, L. Nono, E. Krshenek
Pointillism	A. Webern, K. Stockhausen, P. Boulez,
Concrete and electronic music	P. Schaeffer, K. Stockhausen
Aleatoric	K. Stockhausen, P. Boolez, J. Cage

The expansion of the tonal system, which began in the works of nineteenth-century composers, is reduced to the following basic techniques or their combinations:

1. the widespread use of polytetrachordal chords, both in their primary and inverse forms;
2. the use of altered chords (in some cases, chords with split tones);
3. the formation of modulation chains without being fixed in certain keys.
4. polytonality.

The use of polytertian chords (nonaccords, undecimals, tercdecimals) was widely used in the works of C. Debussy, M. Ravel, L. Revutsky, and later in jazz music, where their use was the most consistently theorized.

Let us take a fragment from the Prelude Op as an example of the use of polytetrachylic structures. 44 #2 by B. Liatoshynsky (Figure 1). The chord sequence in this example looks like this: G_{maj7} – E_{m9} – C_{maj13} – D_{maj9} – E_{m9} – G_{maj7}- $F\#_{m7}$ – A_{m9}

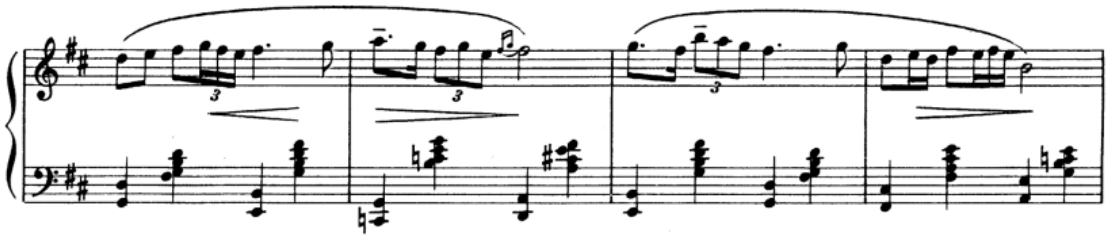

Figure 1. B. Lyatoshinsky. Prelude Op. 44 No. 2, measures 5-9, as an example of the use of polytetrachylic harmony

In some cases, especially in jazz music, polytertiary structures are used in rotations or in a modified arrangement, resulting in individual tones arranged in quarters or tritones, which gives rise to C. It is difficult to interpret such structures as quartal (for example, the tertiary decimals c-e-g-b-d-a in jazz piano music is usually performed in the arrangement c-b-e-a-d-g, which acoustically forms a quartal structure, but functionally remains a tertiary decimals).

Composers of the twentieth century inherited the creation of modulation chains from the works of Wagner. This is explained in the context of the idea of "infinite melody" as an embodiment of the idea of "tension of forces" or "psychic energy" (Kurth, 1920). An example of long chains of modulations without anchoring in intermediate keys is, for example, B. Lyatoshynsky's romance "On Jasper Steps", whose harmonic sequence is presented as follows: H_{m6} – Cis_{7} – A_{m6} – $F_{6/4}$ – Cis_{2} – B – D – Ges – Es_{m} – $G_{6/4}$ – H_{13}->E_{maj7} – Cis_{9}.

Polytone is interpreted as the simultaneous use of more than one harmonic function (Leeuw, 2005, p. 87), and it was used in the works of B. Bartók, I. Stravinsky, and the early works of W. Lutosławski. For example, let us cite the beginning of Paganini's Variations on a Theme, the original theme of which begins in A minor with alternating tonic and dominant functions; the composer imposes Fmaj7, D(add6), Hm harmonies.

The modal system involves the use of artificial sound systems with an arbitrary number of sounds. An early example of the modal system is the use of whole-tone scales in Debussy's preludes (Figure 2) (Benward & Saker, 2003).

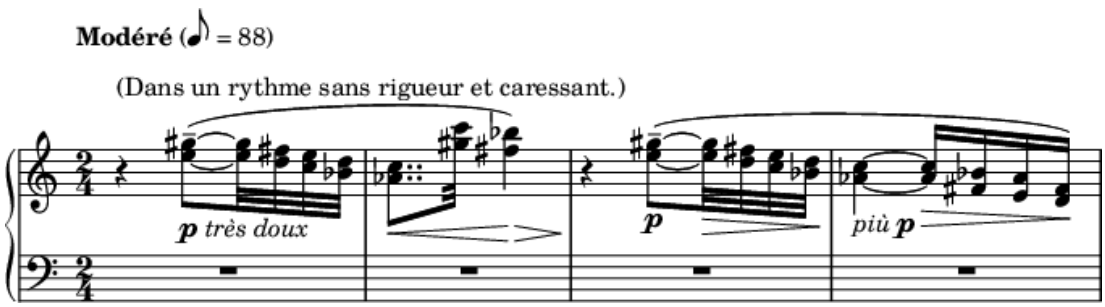

Figure 2. C. Debussy. Prelude "Voiles" as an example of the use of the whole-tone mode

The most consistent embodiment of the modal system is O. Messiaen's "modes of limited transposition", which the author not only implemented in many of his works, but also substantiated in his scientific treatise "The technique of my musical language" (Messian, 1944). While O. Messiaen used mainly static modal models that involved the observance of certain sound systems for a long time, a different approach to modality is observed in the piano works of B. Liatoshynsky, characterized by the use of dynamic modal structures that undergo constant transformations during the unfolding of the musical texture (Bezborodko, 2018). In some cases, modal and non-functional harmonic systems are also found in jazz (Susanni, 2005) and metal (Lulja, 2019) music.

The serial and later serial technique is considered a technique of composition or a method based on the use of a series of sounds as the main constructive material (Griffiths, 2001). The origin of serialism is considered to be the technique developed by A. Schoenberg (see Figure 3), known as dodecaphony, which the author himself characterized as "a method of composition with twelve notes related only to each other" (Schoenberg, 1975).

Initially, the idea of a series of sounds was applied to the pitch parameter so that the 12 sounds of dodecaphony correspond to 12 possible notes within the 12-step sound system used in European Music. Later, the idea of seriality was extended to other parameters of musical sounds, such as dynamics, timbre, and duration. This extension of the serial principle became known as integral serialism or seriality (Iddon, 2023).

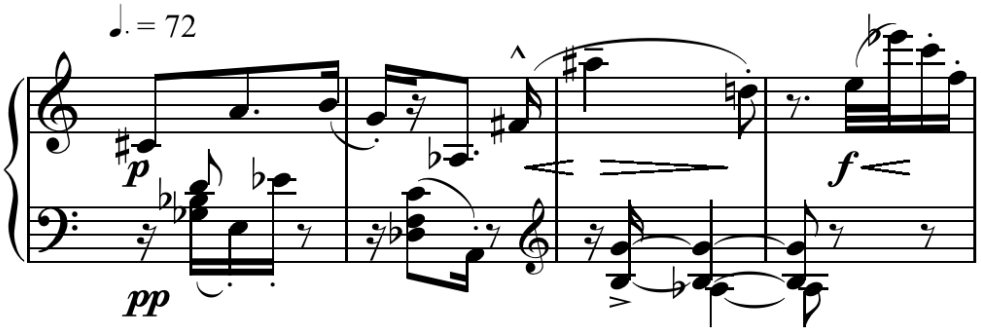

Figure 3. A. Schoenberg. Piece Op. 23, No. 5, as an early example of a dodecaphone

Kohoutek (1965) notes that elements of dodecaphony, following the composers of the New Music school (A. Schoenberg, A. Berg, A. Webern), are also found in the works of composers who generally did not consider it appropriate to completely abandon the tonal principle of organizing the musical fabric, such as I. Stravinsky or D. Shostakovich.

While serial and, especially, serial compositional techniques lead to a significant role of algorithms in the formation of musical integrity, aleatorics, on the contrary, involves a certain degree of randomness and freedom of the musician when performing such compositions. A process is considered aleatory "if its course is determined in general but depends on chance in its details" (Meyer-Eppler, 1957). The most interesting from the aesthetic point of view is "controlled aleatoric". Examples of aleatoric are the late compositions of W. Lutosławski (Rae, 1999). In these compositions, aleatorics can be combined with polytonal structures.

The twentieth century also saw attempts by composers to go beyond the 12-tone system by trying to use alternative sound systems, usually with more steps within an octave. Such attempts are called microintervals or microtonality (Maclagan, 2009). Although alternatives to the 12-tone division of octaves were noted by theorists in the musical cultures of individual nations as early as the musicologists of the 19th century, European composers turned to experiments with micro-interval structures only in the 1920s, including the first composers Alois Hába and Ivan Wyschnegradsky, C. Ives (Haas, 2007).

The difficulty of introducing micro-intervals lies primarily in the technical limitations of traditional instruments, especially keyboards, which provide for a fixed division of the pitch scale. Although attempts were made in the 1920s to design quarter-tone pianos (Lindstedt, 2010, p. 40), such instruments remained the domain of experimentation and did not become widespread.

Microintervals have found their application in spectral Music (J. Grise, T. Murray) and sonority (K. Penderecki, W. Lutosławski). In spectral music, its use is

associated with the desire to form consonances based on sound-spectrum calculations (Fineberg, 2000). In sonoristics, conversely, there was a desire to form the densest possible sound arrays, denser than semitone clusters (Lindstedt, 2010, p. 113).

To a large extent, innovations in twentieth-century music are associated with the invention of electric instruments and electronic sound processing. The invention of electric instruments contributed to "the establishment of the concept of 'artificial ' (synthesized) sound, a significant enrichment of the timbre palette of music of the non-academic tradition and the formation of a decentered timbre space. It also resulted in the transformation of the traditional communicative model "performer - instrument", and the emergence of electronic dance and experimental music" (Kushch, 2013, p. 14). Electronic Music is being formed as a separate musical trend, the main material of which is "characteristic electronically synthesized or electronically dissected sounds" (Bondarenko, 2021, p. 208).

What is also important is that already in the early twentieth century, the landscape of music education underwent a revolutionary shift. A symphony of inventive characters and events transformed the way music was taught, opening up new possibilities and laying the groundwork for contemporary music education as we know it today. The early twentieth century also saw the introduction of technology into music teaching. Phonographs and radio broadcasts enabled students to listen to classical music and performances by well-known performers, extending their musical horizons. This technology enabled a more immersive musical experience.

The paradigm of musician training underwent significant change in the second half of the 20th century, particularly in the final third. Hargreaves et al. (2003) begin with a discussion of the relationship between developmental psychology and music education, describing the mid-1980s as the emergence of the three primary subfields of music psychology: cognitive, developmental, and social. The writers then continue on to the present and beyond, arguing that a significant shift has been the addition of a social perspective and sensitivity to musical style, which, in turn, has further impacted the avant-garde music landscape.

In the 1940s and 1950s, electronic music developed in two competing directions - "concrete music" (P. Schaeffer) and electronic music itself (K. Stockhausen). While the former was aimed at recording and subsequent combinations of sounds of the natural or man-made environment, the latter was actually aimed at synthesizing sounds with the help of electronic technologies. From the point of view of modern electronic music technology, these approaches should be seen as complementary - sampling and synthesis. In the 1970s, electronic music gradually entered the sphere of popular music. By the end of the 20th century, the original sounds of TR-808 and TR-909 became

the basis of electronic dance music trends such as techno and house and their variations.

Dance music and electronic music mostly remain within the classical tonal system. However, the search for timely solutions is becoming the main driving force behind creative innovations in electronic music. The introduction of combinations of timbres that cannot be produced with traditional musical instruments is becoming a distinctive feature of electronic music and the basis for the diversity of its trends. Timbre is becoming a key characteristic of sound, one of the leading means of expression in the musical arts (Reshetnik, 2020, p. 76).

However, electronic music does not exclude the use of innovative harmonic systems. For example, Stockhausen's Etudes uses a serial technique combined with an 81-step octave division (Stockhausen, 1964, p. 37), making this work innovative in timbre and harmony. Electronic music has provided additional opportunities for the development of microintervals because synthesizer programming imposes virtually no technical limitations on the calculation of sound frequencies and, thus, the possibilities of arbitrary division of the sound system (Lindstedt, 2010).

Innovations in the music of the twentieth century also affected the work of composers with folklore material, which received the generalized name of neofolklorism. Neo-folklorism of the first half of the twentieth century is mostly associated with the use of "songs of archaic folklore origin, which were developed on the basis of repetition and variation, often with blurring the contours of the folklore theme" (Derevianchenko, 2005). Among the representatives of this trend are B. Bartók and I. Stravinsky, and partly the early works of B. Liatoshynsky and V. Liutoslavsky. The second folklore wave, associated with the postmodern era, is characterized by "a bolder use of folklore in its 'pure 'and 'pristine 'form, along with the latest means of expression" (Bondarenko, 2021). This wave is characterized by ethnophonisms, which are defined as "the timbre and sound aspect of folk instrumentation" (Broiako, 2020) for instrumental music or the use of folk singing styles (Bondarenko, 2021) for vocal music. This approach is most widespread in Ukraine, thanks to the tradition of, on the one hand, the academicization of such folk instruments as the bandura, and, on the other hand, the cultivation of folk choral singing as an alternative to academic singing, which ensures "the formation of an individual musical sound, which is realized through the appeal to the song folklore of different regions" (Skoptsova & Palyga, 2025). The appeal to folklore motifs gives researchers grounds to talk about "opposition to cultural assimilation and globalization" (Marchun, 2024) and "acquires the features of genre-style and semantic duality" (Zlotnik, 2018).

Because of the extraordinary number of composers and the diversity of music that one must contend with in producing a history of twentieth-century music, it seems impossible to provide an entirely fair or balanced representation in the discussions. Thus, we considered several early twentieth-century composers and many younger ones of true artistic worth. However, even this considered array of prominent musicians, composers, and music development vectors allows stating that the landscape of innovations in 20th-century music represents an integrated and multi-faceted phenomenon, revolutionized and revolutionized in lockstep with the development of technology and transformations of societal fabric.

Conclusions

The study aimed to provide a comprehensive overview of innovations that appeared in music during the twentieth century and determined its stylistic diversity. The article finds that innovations in 20th-century music were most clearly manifested in the harmonic and timbral spheres. The harmony of the music of the twentieth century is diverse and, depending on the creative guidelines of the author, can be characterized as extended tonal or polytonal (C. Debussy, M. Ravel, jazz music), modal or in combination of modal and tonal principles (O. Messiaen, B. Liatoshynsky) and atonal, in particular serial (A. Schoenberg, A. Berg, A. Verben) and serial. Some attempts to update the pitch organization of musical material concerned the introduction of micro-intervals within the tonal logic (A. Gaba) as an imitation of sound spectra (J. Grise, T. Murray) or sonority (K. Penderecki).

The expansion of the timbral palette of musical art in the twentieth century was mainly due to the emergence of electric instruments that allowed the synthesis of unattainable sounds for traditional instruments. By the end of the twentieth century, timbre and harmonic means had become one of the most important means of musical expression. In electronic music, it was a key distinguishing feature of its individual styles.

Innovations also concerned composers' work with folklore material. Unlike 19th-century composers, early twentieth-century composers tried to combine folk song melodies with the latest methods of harmonic and polyphonic development, and in the late 20th century, folklore also became a source of timbral enrichment for opera and symphonic music, and later (at the beginning of the twenty-first century) for electronic music.

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Conflicts of Interests

The authors declare no conflict of interest.

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