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ACOUSTICS AND MUSICAL PHENOMENOLOGY: A SYMBIOSIS BETWEEN SCIENCE AND CONSCIOUS PERCEPTION

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SUMMARY. Acoustics and musical phenomenology are like two sides of the same coin. The former analyzes the objective structure of sound, while the latter explores how this structure becomes alive in human consciousness. Together, they help us understand why music is so profound, not only because it is an impressive physical phenomenon but because, through sound, it reaches the deepest levels of our consciousness.

Keywords: Acoustics, phenomenology, music, frequency, amplitude, timbre and spatiality, pitch, conductor

Music, this universal language that transcends linguistic, cultural, and temporal barriers, can be explored from multiple perspectives. Two of these—acoustics and musical phenomenology—offer different but complementary approaches to sound.

While acoustics analyzes the physical properties of sound waves, phenomenology focuses on how these sounds are perceived, experienced, and integrated into the listener's consciousness. In this intersection between science and experience, we find the key to a deeper understanding of music.

ACOUSTICS[2] s.f. 1. A branch of physics that studies the sounds. ♦ A musical discipline that studies the sounds used in music and the laws governing their perception. 2. The quality of ensuring good sound propagation and perception. [Gen. -cii. / < fr. acoustique]. ACOUSTICS

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[2] https://dexonline.ro/definitie/acustica (accessed on 03.03.2025)

Acoustics studies sound as a physical phenomenon, analyzing it in terms of frequency, amplitude, timbre, and spatiality. In music, these fundamental characteristics are organized to create melody, harmony, rhythm, and expression.

- Frequency determines the pitch of the sound, measured in Hertz (Hz). In an orchestra, this frequency gives each instrument its timbral specificity, from the low tones of the double bass to the high notes of the piccolo.
- Amplitude influences sound intensity and musical dynamics, providing contrast between powerful moments and delicate ones.
- Timbre results from harmonics and the way each instrument produces sound. Acoustics explains why a bassoon and an oboe, or a double bass and a violin playing the same note, sound so different.
- Spatiality (reverberation, instrument positioning in the orchestra) adds a three-dimensional dimension to music, influencing how sound is perceived in a concert hall.

Acoustics is essential for understanding musical instrument construction, concert hall design, and the use of technology in music. However, despite its scientific precision, it remains “mute” in the face of the fundamental question: what does all this mean for the listener?

“The continuous enrichment of the field of acoustics and the need for specialization, dictated by the purposes pursued by the demands of life, have led overtime, particularly since the beginning of the last century, to the emergence of several branches:

- Physical acoustics.
- Architectural acoustics.
- Physiological and psychological acoustics.
- Electroacoustics.
- Technical acoustics.
- Musical acoustics, which focuses on the study of sound phenomena that form the foundation of the art of sound, insofar as their analysis, theory, and practice contribute to establishing the objective (and partly subjective) aspects of music, explaining what is possible and contributing to the progress of some of its components. Within this framework, musical acoustics studies:
- The production of sounds on musical instruments.
- The characteristics of different instruments.
- The physical and psycho-physiological properties of musical sounds.
- The structure of musical intervals (from a physical-mathematical perspective) along with their corresponding psycho-physiological implications.

- The organization of intervals into modes, scales, and chords from an objective perspective, etc."[3]

Musical Phenomenology

Phenomenology, a philosophical concept created by Edmund Husserl, developed by Roman Ingarden, and deepened in the field of music by conductors Ernest Ansermet and Sergiu Celibidache, shifts the perspective from "what is sound?" to "how is sound experienced?" In this paradigm, music is not just a succession of sound waves but a living phenomenon unfolding in time and space, uniquely experienced by each listener in their consciousness. Musical Phenomenology expresses the subjective experience of sound.

Edmund Husserl and the Phenomenology of Music

Edmund Husserl (1859–1938), the founder of phenomenology, did not develop a systematic theory of music in a dedicated work. However, from his general conception of consciousness and phenomenological analysis of time (especially in *Lectures on the Phenomenology of Internal Time Consciousness,* 1905/1917), some relevant ideas for understanding the musical phenomenon can be extracted.

From a Husserlian perspective, music is experienced as a temporal flux that gains unity and meaning through retention, primary impression, and protention, while the listener's consciousness constructs melody and harmony through successive syntheses. In this sense, Husserl's concept of music can be summarized as a phenomenological analysis of temporality that gives rise to a unified aesthetic object in consciousness.

Essentially, the performer and the listener are invited to approach music with a state of total openness, to set aside any external desires, and to experience music at a deep level of consciousness. This approach requires discipline, self-knowledge, and a sincere desire to discover music in its purest form, offering an authentic and transcendental experience in every musical act.

1. Retention and Protention

- Listening to music involves a constant connection between immediate memory (retention) and the anticipation of what is to come (protention).

[3] Urmă, Dem. *Acustică și muzică (Acoustics and Music)*, Scientific and Encyclopedic Publishing House, Bucharest, 1982, pg. 13.

For example, in a *Nocturne* by Chopin or a *Prelude* by Bach, each chord is perceived in the context of the preceding chords but also as an anticipation of what follows.

- Retention and protention, in musical phenomenology, are essential for creating a continuous and meaningful experience of music. They ensure a temporal connection between the past, present, and future, transforming musical interpretation and listening into a unified experience, where each moment is organically linked to the others.
- In musical interpretation, these mechanisms provide meaning and depth, helping the performer create an expressive and coherent arc while allowing the listener to experience music not just as a succession of sounds but as a complex temporal phenomenon, full of significance and continuity.

2. The Meaning of Sound

- From a phenomenological perspective, music is not just a succession of chords or sounds but an expression of a deeper meaning. A simple sequence of sounds is not neutral; it can evoke joy, nostalgia, or melancholy, depending on the context in which it is experienced.

3. The Perception of Sound

- Listening to music is not a purely intellectual process. Music is a felt experience within our body; the vibrations of a double bass can be perceived physically, and energetic rhythms can trigger an instinctive desire to move.

4. Temporality

- Musical phenomenology places special emphasis on time. While acoustics measures time in fixed units, phenomenology reveals how musical time is experienced differently - sometimes perceived as accelerated, other times as expanded by the lyricism of a musical phrase.

Ernest Ansermet[4] (1883–1969) believed that music should be analyzed and experienced in terms of subjective perception. From his perspective, musical phenomenology involves capturing the structures of music as they present themselves to the listener's consciousness, without imposing external judgments or complex theoretical analyses.

For Ansermet, music is not merely a sum of formal elements or compositional techniques; it is a lived phenomenon, experienced in the moment of listening and having a direct impact on the listener's subjectivity.

Ansermet's phenomenological analysis focuses on understanding music from a lived and subjective perspective, without breaking it down into purely technical or formal elements. This phenomenological approach highlights the importance of direct experience and the emotional and intellectual connection between music and the listener, emphasizing that the true understanding of music goes beyond its structural analysis and is found in the phenomenological experience itself.

Sergiu Celibidache saw music as a transcendental experience with the power to connect human consciousness to deep and spiritual essences. In his vision, transcendental consciousness allowed both the performer and the listener to go beyond the limits of reason and ordinary perception, reaching a pure and authentic experience of music. In this state, music becomes more than just a succession of sounds—it transforms into a lived phenomenon, a meditation on existence, and a channel for accessing the fundamental essences of being.

Celibidache's approach to transcendental consciousness and musical experience remains a point of reference for those interested in the profound and spiritual dimension of musical art.

In the phenomenological context, transcendental consciousness offers a new perspective on the experience of music. By accessing this pure state of consciousness, musical experience becomes an inner journey, a way of exploring the self and the universal essences of sound and existence. Both the performer and the listener can connect to a deeper dimension of being, where music is no longer just a sonic phenomenon but a total experience of existence in its essential unity.

"Phenomenology is not an abstract idea, and if we make music, it is thanks to phenomenology. If the relationship between two chords can serve the text, it is nothing but phenomenology. It may seem like an abstract science of an intellectual nature. On the contrary, we all know that it is not of an intellectual nature." [5]

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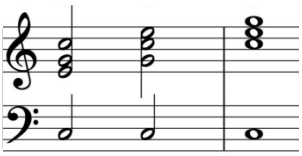
[4] Ansermet, Ernest. 1961. *Les fondements de la musique dans la conscience humaine*. 2 v. Neuchâtel: La Baconnière. New edition, edited by J.-Claude Piguet, Rose-Marie Faller-Fauconnet, et al. Neuchâtel: La Baconnière, 1987.

[5] Sergiu Celibidache. *Phénoménologie de la musique „La fin est dans le commencement"*.

Interaction between Acoustics and Phenomenology

Though seemingly opposed, acoustics and phenomenology are complementary. Acoustics provides the technical language and physical structure of music, while phenomenology reveals how this structure comes to life in consciousness.

E. g. 1



The C Major Chord

Acoustics explains that a major chord consists of harmonic frequencies in simple ratios. Phenomenology shows that this chord can evoke sensations of fullness, stability, or joy.

The Concert Hall

- Acoustics teaches us how to design a hall with optimal reverberation. Phenomenology explores how the listener perceives sound in such a space—how reverberation creates a sense of spatiality that can amplify emotions.

Practical Applications: The Conductor as Mediator

The conductor is the “binding agent” that integrates acoustics with phenomenology. They must understand the acoustic structure of a score while also crafting a temporal and emotional experience for both orchestra and audience. Sergiu Celibidache stated that every sound “has its place in time” - an expression that perfectly encapsulates this duality.

Seminar held at Schola Cantorum in Paris., pg. 62.

The conductor plays a crucial role in creating an interpretative space that allows the audience to perceive music in a state of phenomenological openness. By conveying an authentic interpretation, without artificial embellishments or distractions, the conductor invites the audience to fully immerse themselves in the music, experiencing each moment as part of a unified whole.

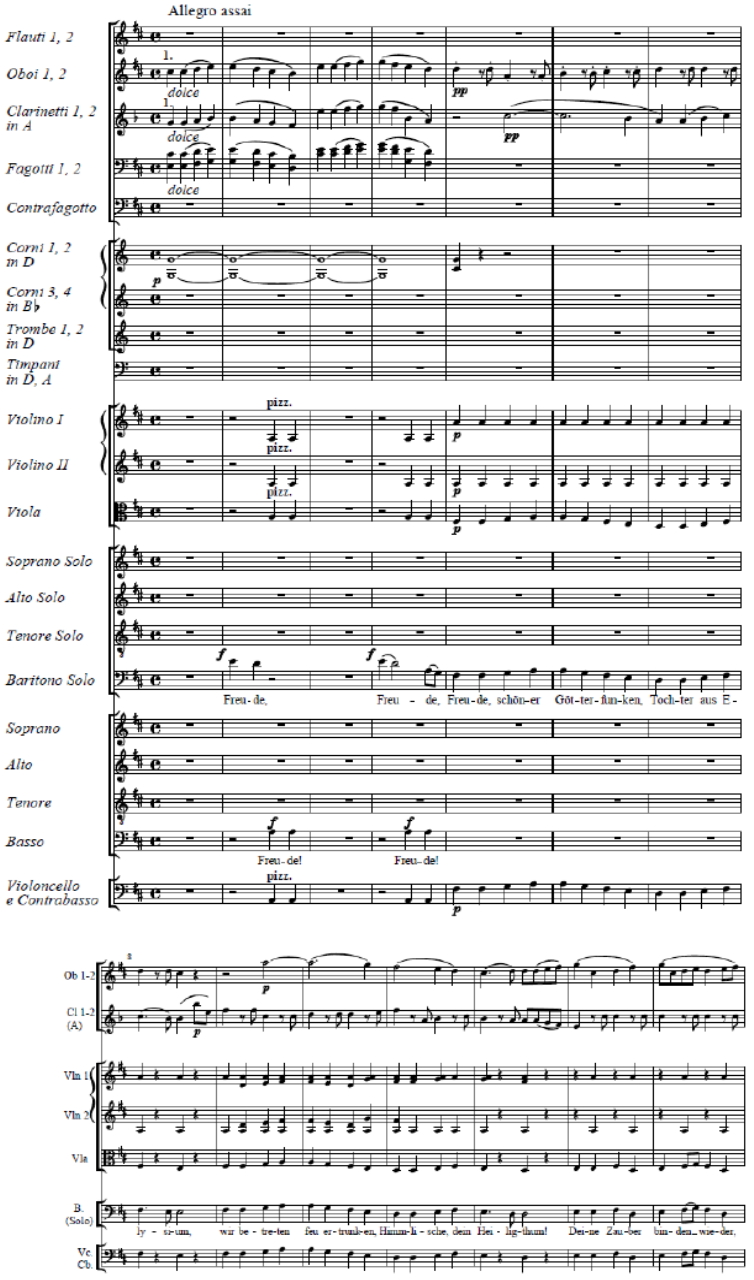
Thus, the audience becomes an active part of the phenomenological experience, feeling the continuity between the beginning and the end and perceiving music on a profound level. To achieve these phenomenological objectives in orchestral interpretation, a conductor must combine a deep understanding of musical structure with sensitivity to the temporal experience of music. They must be able to guide the orchestra in a way that respects the natural flow of music, creating a temporal unity where each moment is connected to the whole.

Through intuitive communication, genuine receptivity, and profound preparation, the conductor can transform interpretation into a phenomenological experience of music, where the beginning and the end merge into an experience of deep continuity and meaning.

The phrase “in the beginning is the end” takes on a complex and profound meaning in musical phenomenology, emphasizing the continuity and interdependence of all musical moments. From a phenomenological perspective, the beginning is not merely a starting point but a premise for the entire musical experience, where the end is anticipated and inherently present in every sound. In music, this idea creates a unified and cyclical experience, where the beginning and the end are organically connected, offering both the listener and the performer a deep temporal experience, in which each moment gains meaning in relation to the whole.

I propose an analytical example based on the theme of acoustics and musical phenomenology, through the analysis of the reverberation phenomenon in a concert hall and how it influences the perception of the musical discourse, specifically the choral passage, “Ode to Joy”, from the finale of Beethoven’s *Symphony No. 9*.

E. g. 2



Ludwig van Beethoven, *Symphony No. 9 in D minor, Op. 125*
Part IV, *Allegro assai*, ms 1-14.

This part of the symphony, like the entire work itself, is a complex masterpiece both orchestrally and vocally, with an extremely high acoustic density. I will propose an analysis that highlights how acoustics and phenomenology intertwine and how they influence the perception of this moment.

1. Acoustic Analysis

From an acoustic perspective, the choral passage in *Symphony No. 9* presents a challenge for both performers and listeners:

a) Sound Spectrum
Full orchestra, vocal soloists, and mixed choir.

- Frequencies covering a wide spectrum, from the low notes of the double basses and timpani to the high notes of the piccolo and sopranos.
- Harmonics: The fundamental frequencies of instruments and voices generate overlapping harmonics, creating an extremely rich sonic mass.

b) Reverberation

- In a concert hall with high reverberation (e.g., 2.5 seconds), overlapping sounds can create an “acoustic haze”. This enhances the sense of grandeur but may compromise the clarity of melodic lines.
- In a hall with short reverberation, each sound dissipates more quickly, providing a clearer perception of details.

c) Specific Acoustic Challenges

- Balance between orchestra and choir: If the orchestra is too powerful, the voices may be overshadowed, especially in passages marked forte. The mid-high frequencies of the choir (essential for text intelligibility) risk being covered by stronger low-register sounds.
- Sound projection: The choir, often positioned behind the orchestra, relies on the hall’s acoustics to project the sound forward.

2. Phenomenological Analysis

From a phenomenological perspective, the choral passage is experienced by the listener as an intense emotional event. Acoustics is not merely a technical factor but becomes a medium through which musical meaning is perceived.

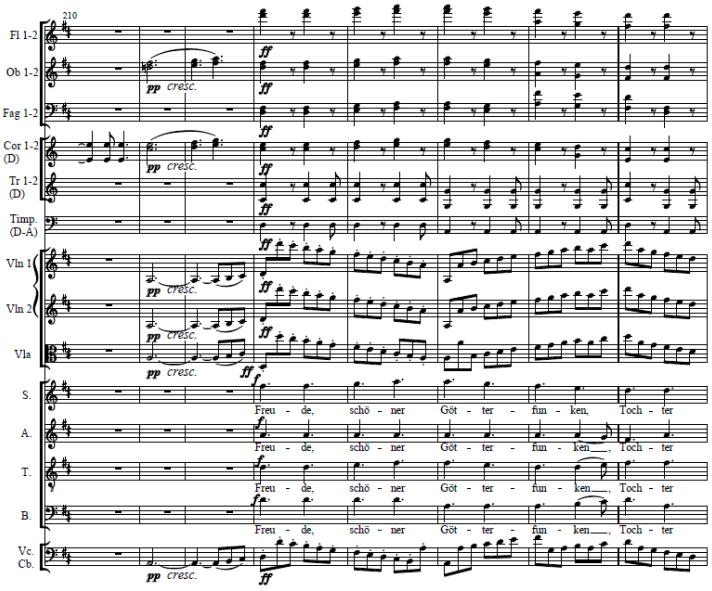
a) Perception of Spatiality

- Reverberation: In a large concert hall, the listener perceives the sound as omnipresent, coming from all directions. This sensation enhances the grandeur and magnificence conveyed by “Ode to Joy”.
- Phenomenologically, the spatial quality of sound creates a feeling of total immersion. The listener feels included in this celebration of humanity.

b) Musical Temporality

- In slow choral passages, reverberation extends each sound, creating a sense of “expanded time”. The listener experiences each phrase as broader, more intense, and more meaningful.
- In fast passages, such as *“Freude, schöner Götterfunken”*, overlapping sounds create a sensation of “continuous flow”. The listener perceives time as accelerated yet unified.

E.g. 3



Ludwig van Beethoven, *Symphony No. 9 in D minor, Op. 125,* Part IV, *Allegro assai*, ms. 210-217.

c) Tension and Resolution

- Harmonic tension: The tonal progressions in this passage create a constant expectation of resolution. Reverberation amplifies this effect, making each harmony “resonate” longer in the listener’s consciousness.

- Resolution: When the final phrases bring harmonic resolution, the listener experiences a profound emotional release. The acoustics of the concert hall further enhance this sensation, giving the resolution an almost transcendent quality.

d) The Meaning of Sound

- The listener perceives the choral passage not just as a sequence of sounds, but as an expression of a universal idea—human fraternity. The collective timbre of the choir, combined with the grandeur of the orchestra, becomes a sonic metaphor for a united humanity.

3. The Interaction between Acoustics and Phenomenology in Interpretation

- Adapting interpretation based on acoustics: The conductor, in shaping the musical discourse, must be aware of both acoustics and the listener's perception:
- In a hall with high reverberation, the tempo should be slightly slowed down to ensure text clarity; dynamics must be adjusted so that voices are not overwhelmed by the orchestra; the conductor should use pauses and diminuendos to allow the sound to "breathe".
- In a hall with short reverberation, the tempo can be faster, as details are perceived more clearly; dynamics can be more expansive, as sounds do not overlap excessively.
- The transition from sound to silence: At the end of the choral passage, as the final chords gradually fade, the listener experiences a phenomenological transition from sound to silence. Long reverberation prolongs this transition, making the silence feel "charged" with the resonance of the preceding sound. This is a moment were consciousness shifts from perception to reflection.

In conclusion, I believe that the analysis of the choral passage from Beethoven's *Symphony No. 9* demonstrates how acoustics and musical phenomenology work together to create a unique experience.

Acoustics provide physical context, determining how sound reaches the ear, while phenomenology reveals how that sound becomes expressive and meaningful in the listener's consciousness. Together, they allow us to understand why this moment remains one of the most moving in the entire history of music.

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