

AUDITORY–MOTOR THINKING AS AN INTENTIONAL STRUCTURE OF MUSICAL PERFORMANCE: PHENOMENOLOGICAL AND SEMIOTIC DIMENSIONS

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SUMMARY. The article substantiates the concept of auditory–motor thinking as a key artistic–cognitive structure of musical performance. Drawing on the phenomenological tradition of analyzing embodied consciousness and the temporality of musical action, it proposes a distinction between sensorimotor integration as the physiological precondition of performance and auditory–motor thinking as an intentionally organized process of shaping artistic meaning. It is demonstrated that musical performance cannot be reduced to the coordination of auditory and motor responses; rather, it emerges as an integral act of performative consciousness in which auditory projection, motor structuring, and expressive regulation are unified within a single temporal perspective.

Keywords: auditory–motor thinking, musical performance, intentionality, interpretation

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Introduction

The problem of the interrelationship between auditory imagery and motor realization has long occupied a significant place in the theory and methodology of musical performance. In different historical periods, musicological thought has emphasized either the primacy of inner hearing as the foundation of an interpretative concept or the decisive role of technical mastery in shaping artistic expression. From early treatises on performance practice to contemporary reflections on artistic interpretation, the unity of hearing and movement has been implicitly recognized as a fundamental condition of professional musical performance.

In the twentieth century, the development of performance theory and music pedagogy increasingly drew attention to the internal mechanisms ensuring coherence between artistic intention and technical execution. Concepts such as inner hearing, musical imagery, kinesthetic control, and the interpretative gesture became central to discussions of performance training. At the same time, interdisciplinary research in cognitive science and the psychology of music introduced the notion of sensorimotor integration, describing the coordination between perception and movement as a complex regulatory system underlying musical action.

Despite this substantial contribution, the theoretical discourse remains fragmented. Within musicology and performance studies, auditory imagery is traditionally positioned as an interpretative-aesthetic construct, whereas motor mechanisms are predominantly examined through the prism of technical and virtuoso parameters. Conversely, in cognitive research, sensorimotor mechanisms are often described at the psychophysiological level without sufficient consideration of their artistic and methodological dimensions. As a result, the conceptual unity of auditory and motor processes in professional musical performance has yet to receive a comprehensive and structurally coherent interpretation within the framework of art studies discourse.

The concept of auditory–motor thinking offers a productive perspective for overcoming this fragmentation. Rather than viewing hearing and movement as parallel or hierarchically subordinated functions, auditory–motor thinking may be understood as an integrated mode of artistic cognition in which inner auditory representation, motor coordination, and expressive intention form a dynamic whole. There is therefore a need for a systematic theoretical clarification of auditory–motor thinking in the context of professional musical performance. Such clarification aims at a holistic account of the structural organization of artistic action, in which auditory anticipation, motor planning, and expressive realization are inextricably interconnected.

The aim of this study is to conceptualize auditory–motor thinking as a systemic artistic–cognitive mechanism of performance activity and to substantiate its interaction with processes of sensorimotor coordination within the methodological framework of music performance theory.

Literature Review

The relevance of the study of auditory–motor thinking is due to the growing interest in embodied–cognitive mechanisms of musical performance within the framework of contemporary interdisciplinary scholarship. In the twentieth and twenty-first centuries, performance art has increasingly been conceptualized not only as an aesthetic phenomenon but as a complex cognitive system integrating perceptual, motor, emotional, and intellectual processes. In this context, the problem of interaction between hearing and movement acquires particular significance, as it determines the specificity of musical performance activity as an embodied form of thinking.

Research on auditory–motor interaction has been actively developing within the field of cognitive neuroscience of music. The works of R. Zatorre, V. Penhune, and J. Chen demonstrate the existence of close functional connections between auditory and motor regions of the cerebral cortex, emphasizing that even passive listening to music activates motor structures⁵. In the study by R. Zatorre and A. Halpern, the role of auditory imagery in the formation of internal musical representations is substantiated, providing a theoretical foundation for the subsequent conceptualization of the phenomenon of audiation⁶. The concept of audiation was developed by E. Gordon, who defined it as the ability to hear and comprehend music internally, in the absence of physical sound, emphasizing the cognitive dimension of musical perception⁷.

In parallel, within the psychology of music, a research direction emerged that focuses on sensorimotor coordination and rhythmic synchronization. The works of A. Patel⁸ and M. Leman⁹ emphasize the role of embodiment in

⁵ Zatorre, Robert J., Joyce L. Chen, and Virginia B. Penhune. "When the Brain Plays Music: Auditory–Motor Interactions in Music Perception and Production." *Nature Reviews Neuroscience* 8, no. 7, 2007, pp. 547–558.

⁶ Zatorre, Robert J., and Andrea R. Halpern. "Mental Imaging of Musical Sounds." *Cerebral Cortex* 3, no. 1, 1993, pp. 29–38.

⁷ Gordon, Edwin E. *Roots of Music Learning Theory and Audiation*. Chicago: GIA Publications, 2011.

⁸ Patel, Aniruddh D. "The Evolutionary Neuroscience of Musical Beat Perception." *Frontiers in Systems Neuroscience* 8, no. 57, 2014. <https://doi.org/10.3389/fnsys.2014.00057>

⁹ Leman, Marc. *Embodied Music Cognition and Mediation Technology*. Cambridge, MA: MIT Press, 2007.

processes of musical understanding, considering movement as an integral component of musical cognition. The theory of *embodied music cognition*¹⁰, developed by M. Leman, has become an important methodological foundation for integrating perceptual and motor aspects into a unified model of musical experience.

Within art studies and performance discourse, the problem of the musician's thinking has been examined through the prism of interpretation, creative intention, and artistic meaning-making. A significant contribution to the study of performative thinking has been made by M. Davydov¹¹, D. Johnson¹², V. Samitov¹³, V. Moskalenko¹⁴, I. Pyaskovsky¹⁵, V. Zaiets¹⁶, O. Markova¹⁷, as well as M. Krausz¹⁸, who analyzed the nature of interpretation as a cognitive act.

These works emphasize the intellectual–emotional balance, interpretative strategies, and artistic reflection of the performer. At the same time, the motor component has predominantly been regarded as a technical precondition for the realization of an interpretative concept rather than as an integral element of the thinking process itself.

Despite the substantial body of existing research, contemporary scholarly literature demonstrates a certain fragmentation in the interpretation of auditory and motor processes. Neuroscientific studies primarily focus on mechanisms of integration and functional connectivity; psychological research emphasizes mental representations and sensorimotor coordination, whereas musicological scholarship concentrates on interpretative aspects of performance. However, a holistic conceptualization of auditory–motor thinking as an integrative

¹⁰ Leman, Marc. *The Expressive Moment: How Interaction with Music Engenders Meaning*. Cambridge, MA: MIT Press, 2016.

¹¹ Davydov, Mykola. *Theoretical foundations of formation of performance skills of an accordionist*. Kyiv, Musical Ukraine, 2004, 240 p.

¹² Johnson, Daniel C. *Holistic musical thinking: a pedagogical model for hands-on and heart - felt musical engagement*. Series: Routledge new directions in music education series. New York, NY: Routledge, 2024, 118 p.

¹³ Samitov, Viktor. *Theoretical foundations of professional thinking of a performing musician as a criterion of professional skill*. Lutsk, Volyn regional printing house, 2011, 272 p.

¹⁴ Moskalenko, Viktor. *The creative aspect of musical interpretation (to the problem of analysis)*. Kyiv, Muzinform, 1994, 157 p.

¹⁵ Pyaskovskiy, Igor. *The logic of musical thinking*. Kyiv, Musical Ukraine, 1986, 180 p.

¹⁶ Zaiets, Vitalii. "The Way of Thinking in the Context of the Specificity of the Music Performance." In *Horizonty umenia 7: Zborník príspevkov z medzinárodnej vedeckej konferencie*, 16, Banská Bystrica: Akadémia umení v Banskej Bystrici, 2020, pp. 160-172.

¹⁷ Markova, Olena. *Questions of the theory of performance: materials for the theory of performance theory for master's and graduate students*. Odessa: Astroprint, 2002, 128 p.

¹⁸ Krausz, Michael (ed.). *The Interpretation of music: philosophical essays*. Oxford: Oxford University Press, 1993, 288 p.

artistic-cognitive mechanism operating in real time within performance activity remains insufficiently developed.

Thus, there is a need for a theoretical synthesis of these heterogeneous approaches and for the formulation of a concept of auditory–motor thinking that integrates neurophysiological, psychological, and musicological dimensions. Such an approach will enable a deeper understanding of the cognitive foundations of musical performance, refine the methodological principles of performance pedagogy, and expand current perspectives on the embodied nature of musical cognition.

Discussion

The introduction of the concept of *auditory–motor thinking* into scholarly discourse is undertaken as an attempt to conceptualize an integrative type of professional mental activity characteristic of the performing musician. This concept does not claim terminological novelty within the broader field of the psychology of thinking; rather, it is proposed as an analytical category intended for the systematic examination of the interaction between auditory representations, motor actions, and cognitive processes within the immediate process of musical performance.

In the present study, *auditory–motor thinking* is defined as an integrative form of performance consciousness in which auditory projection, motor planning, and expressive regulation are unified within a single intentionally directed act that ensures the anticipation, formation, and artistic organization of musical sound in time. Such an understanding makes it possible to regard auditory–motority not merely as a mechanism of coordination, but as a structural principle of the performer’s artistic thinking, in which technical action and interpretative intention emerge as aspects of a unified process.

In contemporary musicology and research on musical cognition, various concepts are employed to describe the interdependence of auditory and motor processes, including *auditory–motor integration*, *auditory–motor imagery*, *audiation*, as well as terms reflecting neurophysiological and cognitive aspects of interaction, such as *auditory–motor interactions*, *auditory–motor entrainment*, *auditory–motor synchronization*, and *auditory–motor coupling*. Each of these approaches highlights a particular dimension of the relationship between sound and movement: integration emphasizes functional and neurophysiological mechanisms; imagery concerns the mental simulation of movements and sounds; audiation refers to the capacity to internally hear music; auditory–motor networks describe the structural organization of interactions between auditory and motor systems, whereas synchronization characterizes their temporal coordination during performance.

However, none of these terms adequately reflect a holistic process in which auditory and motor components function as a single intentionally organized structure of performance consciousness in real time. In contrast to related concepts, *auditory–motor thinking* delineates the integrated interaction of hearing and movement as a mechanism of artistic meaning-making that enables the simultaneous anticipation, planning, and interpretative modelling of musical material.

This can be explained by the fact that thinking integrates all human mental processes in accordance with the nature of activity, thereby making it possible to distinguish aspects of analytical activity and to investigate the regularities of its functioning.

Auditory–motor thinking may be considered in both functional and categorical dimensions. In the functional sense, it is associated with the regulation of performance actions – the planning, coordination, and control of sound production based on established auditory representations. However, such an understanding remains only partial.

In the present study, auditory–motor thinking is interpreted in a broader, categorical sense as a specific type of artistic-cognitive organization of performance activity. It is not reducible to a set of coordination mechanisms; rather, it emerges as an integral system in which auditory projections, motor structures, and interpretative intentions interact in real time.

Within this framework, hearing and motor activity do not function as autonomous subsystems that sequentially implement a previously formed artistic conception. Instead, they operate as interpenetrating components of a unified process in which artistic meaning is formed through bodily organized action. It is precisely this interaction that determines the specificity of professional performance thinking as a form of embodied creative activity.

Within the context of the proposed concept, a methodological dilemma arises: can auditory representation be considered primary in relation to motor action, or does movement function as the initiating mechanism in the formation of the sonic image? Traditional models of performance often assume a hierarchical structure in which artistic intention precedes technical realization. However, such a linear scheme fails to reflect the dynamics of the real performance process.

Hearing and movement do not exist in a causal sequence. Rather, they interact within a single intentional field in which sonic anticipation and bodily action emerge within a shared temporal horizon. Sound does not precede movement as an abstract plan, just as movement is not an autonomous physiological reaction. Both dimensions are co-constituted in the process of the artistic unfolding of music.

Thus, the question of “what comes first?” appears to be the result of an analytical fragmentation of a unified process. In actual performance practice, auditory–motor thinking functions as a synchronous and projective structure in which anticipation, motor planning, and interpretative intention constitute mutually conditioned aspects of a holistic artistic act.

Within the structure of auditory–motor thinking, inner hearing performs the function of a “reference standard” against which the actual sonic outcomes of performance actions are compared. Research demonstrates that well-developed inner hearing enables musicians to learn new repertoire effectively even in the absence of external sound, compensating for the lack of auditory feedback. This phenomenon directly correlates with the concept of audiation developed by E. Gordon, which in music pedagogy emphasizes the capacity to internally hear and cognitively process musical sound in the absence of external stimuli¹⁹. Audiation represents a form of musical thinking grounded in auditory imagery; however, unlike auditory–motor thinking, it does not consider motor structure and embodied intentionality as constitutive components of performance.

A phenomenological perspective makes it possible to achieve a deeper understanding of the processes underlying musical performance. Within the phenomenology of perception, perception and movement are not regarded as separate faculties, but rather as aspects of a purposeful life experience, as emphasized by M. Merleau-Ponty²⁰. Movement is always oriented toward projected meaning: it is not merely a physiological reaction, but an embodied awareness of intention. Musical performance cannot be reduced either to the precision of movement or to auditory control alone; rather, it constitutes an intentional act in which sound is anticipated, shaped, and embodied in time, thereby acquiring artistic significance.

From this perspective, auditory–motor thinking denotes a higher level of artistic-cognitive organization. It is neither simply the coordination of hearing and movement nor merely an internal auditory representation. Instead, it represents a living organization of performance consciousness in which auditory projection, motor structure, and expressive regulation are unified within a single intentional act. Through this unity, the musician does not merely reproduce sonic material but endows it with artistic meaning and interpretative depth.

¹⁹ Gordon, Edwin E. *Roots of Music Learning Theory and Audiation*. Chicago: GIA Publications, 2011.

²⁰ Merleau-Ponty, Maurice. *Phenomenology of Perception*. Translated by Colin Smith. London: Routledge & Kegan Paul, 1962.

Whereas auditory–motor integration ensures technical accuracy, auditory–motor thinking operates at the level of semantic and expressive formation of music. The performer anticipates sound even before producing it and shapes it through movements that embody inner intentionality.

Sensorimotor mechanisms constitute a necessary condition of performance, yet they do not exhaust its artistic ontology. Auditory–motor thinking transforms embodied coordination into a fully developed interpretative action in which technique, hearing, and artistic intention are organically integrated within the process of musical performance.

The conceptual distinction between auditory–motor integration and auditory–motor thinking becomes particularly evident considering the phenomenological category of temporality, the notion of artistic gesture, and the semiotic understanding of musical meaning.

According to M. Merleau-Ponty, lived time is not a sequence of isolated moments, but rather a dynamic horizon in which retention (recent past), primal impression (the present), and protention (the anticipated) form a continuous intentional structure²¹. It is precisely within this temporal field that musical performance unfolds.

From this perspective, auditory–motor thinking possesses not a reactive but a projective character. The performer does not merely coordinate actions with the sounding material but projects an acoustic future. Motor actions are guided by pre-reflective auditory anticipation, which determines phrasing, articulation, and the expressive artistic-intonational contour even prior to the physical realization of sound.

Thus, whereas auditory–motor integration regulates synchrony and the accuracy of coordination, auditory–motor thinking organizes the temporal directedness of musical action. It structures the unfolding of musical material in time rather than merely ensuring its technical coherence.

The concept of the artistic gesture developed by R. Hatten²² proposes a mediating category between hearing and movement. Gesture cannot be reduced to a biomechanical act; rather, it constitutes a meaningful, temporally shaped action that embodies expressive intention. Whereas auditory–motor integration explains how movement corresponds to sound, the notion of artistic gesture explains how movement becomes meaningful – a perspective examined in detail in the work of R. Godøy and M. Leman²³.

²¹ Merleau-Ponty, *Phenomenology of Perception*, 32.

²² Hatten, Robert S. *Interpreting Musical Gestures, Topics, and Tropes: Passion, Sorrow, and Joy*. Bloomington: Indiana University Press, 2004.

²³ Godøy, Rolf Inge, and Marc Leman, eds. *Musical Gestures: Sound, Movement, and Meaning*. New York: Routledge, 2010.

In this sense, auditory–motor thinking manifests itself through gesture. Gestures emerge as a visible trace of an internal auditory projection. The performer's bodily movements are not secondary to sound production; rather, they function as an expressive medium within which artistic meaning crystallizes. Thus, gesture acts as a mediator between auditory anticipation and acoustic realization, transforming physiological coordination into artistic form.

A semiotic perspective further deepens this differentiation. According to J. Nattiez²⁴, musical meaning is formed within three interrelated dimensions: the poietic (production), the neutral (material trace), and the esthetic (perception). Performance belongs to the poietic dimension as it is precisely through performance that the process of meaning formation is organized²⁵.

Auditory–motor integration functions predominantly at the neutral level – as a mechanism ensuring the execution of performance. By contrast, auditory–motor thinking belongs to the poietic level: it structures interpretative intention and determines the way the musical text is embodied in time.

Similarly, the theory of musical gestures developed by R. Hatten demonstrates that expressive movement possesses semiotic value, as gesture represents stylistic, rhetorical, and emotional codes. Accordingly, auditory–motor thinking is not merely a mechanism of coordination but a semiotic construction that organizes the embodiment of musical signs within performance action.

By integrating the phenomenon of temporality, the category of gesture, and the semiotic dimension, auditory–motor thinking emerges as a concept that transcends reductionist sensorimotor explanations. It designates the moment at which embodied coordination is transformed into artistic meaning. From this perspective, musical performance is not a chain of sensorimotor events but a temporally organized, gesture-mediated, and semiotically structured act of consciousness.

In this context, the introduction of the concept of auditory–motor thinking makes it possible to overcome the traditional dualism between the “spiritual” (interpretation, artistic image) and the “bodily” (technique, movement) in musical performance. These dimensions appear not as autonomous spheres but as aspects of a unified process in which artistic intention is realized through integrated auditory–motor structures. Technique ceases to function merely as an instrumental prerequisite for interpretation and instead becomes a mode of its embodiment; correspondingly, interpretation is not externally added to performance but is formed within the organization of auditory–motor action.

²⁴ Nattiez, Jean-Jacques. *Music and Discourse: Toward a Semiology of Music*. Translated by Carolyn Abbate. Princeton: Princeton University Press, 1990.

²⁵ Nattiez, *Music and Discourse*, 10-12.

From this follows the explanatory potential of the concept regarding the phenomenon of performance interpretation. Artistic interpretation does not emerge as a superstructure imposed upon the technical realization of the notated text, but as a qualitative characteristic of auditory–motor thinking itself. It is manifested in the musician's capacity to discover individual auditory–motor solutions – in phrasing, dynamic modelling, articulatory organization, and timbral regulation – that confer expressivity, coherence, and uniqueness upon performance.

Thus, auditory–motor thinking functions as the category that allows performance to be understood as a process in which artistic meaning is not superimposed upon technique but arises within it.

The proposed concept of auditory–motor thinking makes it possible to reconsider the performance process beyond reduction to sensorimotor coordination or internal auditory imagery. Its heuristic value lies in enabling the description of musical performance as an intentionally structured activity in which auditory anticipation does not precede movement as an abstract plan but is formed together with bodily action within a shared temporal horizon. In contrast to models focused primarily on neurofunctional mechanisms of auditory–motor interaction, auditory–motor thinking reveals performance as a process of artistic meaning-making, in which gesture acts as a mediator between potential sound and its material realization. Such a perspective allows the integration of findings from cognitive music science with phenomenological descriptions of performance experience and the semiotics of musical meaning, thereby forming a discipline-related analytical framework for the study of professional musical performance.

The proposed concept of auditory–motor thinking also opens new possibilities for further research across various domains of musicology and performance studies. It may be applied to the analysis of interpretative strategies in diverse instrumental and vocal practices, to investigations of the corporeality of musical gesture, and to pedagogical models concerned with the formation of professional performance mastery. From an interdisciplinary perspective, the concept establishes a shared analytical field for dialogue between cognitive music science, the phenomenology of experience, and the semiotics of musical meaning. In this way, auditory–motor thinking emerges not only as a descriptive category but also as a heuristic instrument for further theoretical and applied reflection on musical performance.

Conclusions

1. Sensorimotor integration constitutes a necessary but not sufficient condition of musical performance: it ensures the physiological coordination of action but does not exhaust its artistic ontology.
2. Auditory–motor thinking is defined as a higher level of organization of performance consciousness within which auditory projection, motor action, and expressive regulation are integrated into a single intentional act.
3. In the phenomenological dimension, auditory–motor thinking functions as the temporal horizon of musical action, ensuring the anticipation, formation, and articulation of the sonic outcome.
4. The introduction of this category makes it possible to overcome the dualism of “technique versus interpretation,” representing them as aspects of a unified process of embodied artistic meaning-making.
5. Artistic interpretation emerges as a qualitative characteristic of auditory–motor thinking and is realized through the musician’s capacity to discover individual auditory–motor solutions that confer expressivity, coherence, and stylistic uniqueness upon performance.
6. The proposed concept may serve as a theoretical foundation for further interdisciplinary research on musical performance within the contexts of phenomenology, cognitive science, and performance pedagogy.

REFERENCES

- Davydov, Mykola. *Theoretical foundations of formation of performance skills of an accordionist*. Kyiv, Musical Ukraine, 2004, 240 p.
- Godøy, Rolf Inge, and Marc Leman, eds. *Musical Gestures: Sound, Movement, and Meaning*. New York: Routledge, 2010.
- Gordon, Edwin E. *Roots of Music Learning Theory and Audiation*. Chicago: GIA Publications, 2011.
- Hatten, Robert S. *Interpreting Musical Gestures, Topics, and Tropes: Passion, Sorrow, and Joy*. Bloomington: Indiana University Press, 2004.
- Johnson, Daniel C. *Holistic musical thinking: a pedagogical model for hands-on and heart-felt musical engagement*. Series: Routledge new directions in music education series. New York, NY: Routledge, 2024, 118 p.
- Krausz, Michael (ed.). *The Interpretation of music: philosophical essays*. Oxford: Oxford University Press, 1993, 288 p.

- Leman, Marc. *Embodied Music Cognition and Mediation Technology*. Cambridge, MA: MIT Press, 2007.
- Leman, Marc. *The Expressive Moment: How Interaction with Music Engenders Meaning*. Cambridge, MA: MIT Press, 2016.
- Markova, Olena. *Questions of the theory of performance: materials for the theory of performance theory for masters and graduate students*. Odessa: Astroprint, 2002, 128 p.
- Merleau-Ponty, Maurice. *Phenomenology of Perception*. Translated by Colin Smith. London: Routledge & Kegan Paul, 1962.
- Moskalenko, Viktor. *The creative aspect of musical interpretation (to the problem of analysis)*. Kyiv, Muzinform, 1994, 157 p.
- Nattiez, Jean-Jacques. *Music and Discourse: Toward a Semiology of Music*. Translated by Carolyn Abbate. Princeton: Princeton University Press, 1990.
- Patel, Aniruddh D. "The Evolutionary Neuroscience of Musical Beat Perception." *Frontiers in Systems Neuroscience* 8, no. 57, 2014.
<https://doi.org/10.3389/fnsys.2014.00057>
- Pyaskovskiy, Igor. *The logic of musical thinking*. Kyiv, Musical Ukraine, 1986, 180 p.
- Samitov, Viktor. *Theoretical foundations of professional thinking of a performing musician as a criterion of professional skill*. Lutsk, Volyn regional printing house, 2011, 272 p.
- Zaiets, Vitalii, Zaiets, Oksana. *Modifying processuality of emotions of a musician-performer*. *Studia UBB Musica*, LXVIII, Special Issue 2, Cluj-Napoca, 2023, pp. 197-206.
- Zaiets, Vitalii. "The Way of Thinking in the Context of the Specificity of the Music Performance." In *Horizonty umenia 7: Zborník príspevkov z medzinárodnej vedeckej konferencie*, 16, Banská Bystrica: Akadémia umení v Banskej Bystrici, 2020, pp. 160-172.
- Zatorre, Robert J., and Andrea R. Halpern. "Mental Imaging of Musical Sounds." *Cerebral Cortex* 3, no. 1, 1993, pp. 29-38.
- Zatorre, Robert J., Joyce L. Chen, and Virginia B. Penhune. "When the Brain Plays Music: Auditory-Motor Interactions in Music Perception and Production." *Nature Reviews Neuroscience* 8, no. 7, 2007, pp. 547-558.