

Emotions and cognition in the music service

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Abstract: *In this scientific paper, we propose an approach necessary for the understanding of the process of musical creation and interpretation, from the perspective of psychology. We believe that music acts directly, consciously or not, on the brain, thoughts and affections, and especially on the spirit of a melomaniac. Achieving vocal, instrumental, conducting performances or performances in the field of musical creation is similar to accessing and amplifying thinking as well as psychic mechanisms such as motivation, affectivity, communication, attention, will to stimulate behaviour and regulate it. In the present study, we undertake a demonstration of the cognitive and emotional involvement in the musical act, by correlating the voluntary effort essential to building a musical attitude, either interpretative or compositional, which involves the presence of a conscious act with the continuous presence of emotions.*

Keywords: *emotions; music; psychology; intellect; cognition.*

1. Introduction

Music is art and science equally, manifested as a human activity from immemorial time and signifies the human need to communicate harmoniously, expressing feelings and affections through sound. Music is a vector of the human evolution that unites the past with the present, the ego with the superego, the conscious with the subconscious, the materiality with the spirituality. Music is a form of human culture whereby man can overcome his condition by exploring areas and meanings of the human activity that make life meaningful. "In man, the psyche leads and instructs life, mediates the surpassing of nature through culture." (Zlate M., 2009, p. 64).

An etymological approach of the word music reveals that it originates in Latin, *musica*, which comes from the *musaion-museon-muse* triad, meaning *the art of the muses*. The nine muses in Parnas, Pind and Elicone were the protective goddesses of arts and sciences. Euterpe was the muse of music, of harmonious sounds. Thus, the word *muse*, as root of the noun analysed, defined the notion of music. "Music is the art of thinking with sounds," a phrase of the French musicologist Jules Combarieu, expressing plastically the ambivalence of music as a theoretical and practical aspect. The two dimensions of music, art and science reveal a unitary image offered by the musicologist Anatol Vieru: "music is an audible, but invisible time." (Anatol Vieru, 1994, p. 74)

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2. Concepts

Related to **human senses**, psychology detects visual, auditory, olfactory, kinaesthetic, tactile perceptions. In the music field, there are three of the five categories of perceptions: auditory, visual, tactile. Specialty studies draw attention on the fact that perceptions influence and even control behaviour and personality. The environment, being a variable of the human evolution, undoubtedly influences and controls our attitude. "In the opinion of the great psychologists of perception, Hermann von Helmholtz, Richard Gregory, Irvin Rock and Roger Shepard, perception is a deduction process and implies a probability analysis. The brain's task is to determine what is the most probable arrangement of objects in the physical world based on a certain pattern of information that reaches sensory receptors - the retina in the case of vision, the eardrum in the case of hearing. "(D.J. Levitin, 2010, p. 116) Thus, perception becomes a belief, causing even a rewriting of the genes. The perception of the environment can go as far as to influencing the cell. Following the process, the harmony effect of a musical work is dependent on individual perceptions, but at the same time surpassing this primordial level of connection with music, we advance towards the analytical attitude, accessing the next level, that of **thinking**.

The brain is an organ of the human body, located in the skull, wrapped in a membrane called meninge, and contains between 85 and 100 billion neurons, which in turn have about 10,000 connections. The functions of the brain make it behave like an orchestral ensemble, coordinating the behaviour of the body according to the information received. The four lobes (frontal, temporal, parietal, occipital) to which the cerebellum is added are directly responsible for the human behaviour.

The neuron is the foundation of the nervous system, which by its complex architecture (cellular body, axon and dendrites) facilitates the way of transmitting nerve impulses. **Neurotransmitters** are chemicals that transmit and amplify nerve impulses, just like liquid carriers. More than 50 varieties of neurotransmitters are known. **The synapse** is the gateway between two neurons, and each neurocitus can develop over 1,000 synapses. They allow the transfer of molecules by neurotransmitters to circulate throughout the nervous system.

The function of myelin has proved to be overwhelming in supporting cognitive activities. The human being, proving perseverance in an activity, activates myelin, meaning that, the lipoprotein layer is insistently running, thus protecting it. This spiral signifies the formation of skills and habits in time. "The truth is that through training, myelin is produced, and myelin leads to perfection." (Daniel Coyle, 2013, p. 54)

Of course, the human brain of the 21st century is a consequence of evolution to the present because "the brain has a property called neuroplasticity, the ability to significantly change its structure and how it works." (Richard J. Davidson Begley Sharon 2013, p. 31). **The neuroplasticity** of the brain is that feature that can transform itself structurally and functionally, as a result of its own thoughts and social interaction. This property gives every person the opportunity to adopt and advance in any creative activity. Music is the field that can influence brain development through neurogenesis, causing neuroplasticity. Exercising an instrument, at an early or mature age, facilitates the expansion of the cortical area, which, in this way, is more intensely used.

The intellect is the brain operating tool, designating a person's ability to achieve **thinking**. Just as Paul Popescu-Neveanu (1976, 1990) reactivating the older notion of

intellect, introduces thinking into it, which he considers a distinctive feature, the most important of the human psyche, defining for the man as subject of logical, rational knowledge." (Zlate, M., 2009, pp. 155-156). Thinking is the cognitive process that optimizes the assimilation of information and which, through specific operations (analysis, synthesis, comparison, abstraction, materialization, generalization, individualization), makes the connection between objects and phenomena transforming them into notions, judgements and reasoning.

Musical thinking involves the development of a neural network, the sooner the more beneficial to a vocational development, and, if it is at a more advanced age, to experience in the field. Interesting is the resemblance in the designated concept, the definition of musical thinking to two personalities, Pascal Bentoiu and Daniel Levitin, each significant in his field, music and psychology, in different cultures, Romanian and American, in different years, 1973 respectively 2010. The musicologist Pascal Bentoiu makes this concept of musical thinking known by saying: "The composer becomes acquainted with many of them (sound images) during his apprenticeship, and he learns little by little to soften the materials thus learned and even to invent new compositions. Each musical style is a specific way of thinking (operating with sound images); it can be likened to a spoken language that would have its lexical, its topic, its particular grammatical forms, its degree of possible abstraction." (Bentoiu P., 1973, p. 19) From the perspective of neuroscience research, almost four decades later, Daniel J. Levitin states in another composition: "Our brain learns a sort of musical grammar specific to the music of our culture just as we learn to speak our culture language." (Levitin DJ, 2010, p. 124)

The two hemispheres of the brain, involved in the process of thinking, according to studies conducted by the American cognitivist psychologist Daniel J. Levitin, are responsible for the musical thinking, the labour of a musician, both cognitively and emotionally. The right hemisphere processes aspects of musicality, sensitivity, without quantifying the mathematical relations between sounds. The left hemisphere is involved in rational processes underlying music, which governs music theory, counterpoint art, harmony. Musical thinking, this complex cognitive dimension, which is a consequence of neural connections, is not singular in its existence, it is accompanied by a multitude of emotions, states and affections, because it determines musical interpretation or remembrance. And so, several areas of the brain are activated, which also determines emotional involvement. Researches in cognitive psychology and neuroscience have shown that the musician's activity involved accessing both prefrontal and cerebellum areas.

Because we have previously said that music is art and science, we also argue the criterion that supports musical art in particular and any aesthetic manifestation, in general: **emotion**. For "music is an organized sound but the organization must also involve an unforeseen element, otherwise it is flat and mechanical at affective level." (Levitin D.J., 2010, p. 194) Emotions are those psychic processes that constitute the impetus of an action. Etymologically, we explain the word emotion by translating the verb *motere* (from Latin), meaning *to move*. The metaphor of the word means the various experiences that build and dynamize human actions. The artists, through their preparation and the field of manifestation, are a continuous source of disclosure of all communication ways, involving emotions. One way to experience an emotional state is to listen to music, and, in the case of a vocation, to

practice a musical activity, composing or performing music. The primary purpose of interpreting, transmitting music is to excite, to shape a pleasant emotional state.

Some studies report 48 emotions (*Human-Machine Interaction Network on Emotion (HUMAINE)*), divided into categories and subcategories: positive, soothing, lively, reactive, negative. Steve J. DeRose studied and quantified about 800 emotions. Other researchers selected the most common emotions, integrated into a wider transcultural context that recognized a certain similarity in their expression. "A central problem of the study of emotions in psychology remains the transcultural and inter-individual universality of the facial expressions of emotions." (Miu A. 2013, p. 107) Paul Ekman thinks that six emotions are relevant: joy, sadness, anger, disgust, fear, surprise. Robert Plutchick adds to those above mentioned, two others: trust and anticipation. W. Gerrod Parrott distinguishes six emotions which he considers fundamental: joy, sadness, anger, love, fear, surprise.

3. Research on the hypothesis

3.1. Purpose and objectives of the research

After thoroughly researching in the music and psychology fields, we have found that music is emotional and intellectual expression in varying proportions, depending on the individual, but always in the appropriate alloy to support the artistic act. Getting vocal, instrumental, or conducting performances is similar to accessing and amplifying thinking as well as psychic mechanisms such as motivation, affectivity, communication, attention and will to stimulate behaviour and regulate it. Starting with the voluntary effort to build a musical attitude, either interpretative or compositional, which involves the presence of a conscious act, music demonstrates the involvement of the cognitive act conjugated to the emotional one.

All those aspects relating to musical construction, the genre, interior architecture, interval, phrasing, polyphonic, harmonic, rhythmic superpositions, syntactical constructions suppose the involvement of elaborate thinking based on experience and perseverance in the field. Emotions refine the melodic lines, inducing the musical expressivity determined by the timbered, dynamic sounds, by a certain support of the sound discourse. These levels are indisputably decryptable to the human brain, with obvious resonances in each person's psyche.

3.2. Hypothesis

It is assumed that there is a positive correlation between the mastery of emotions and the musical thinking of students from the Music program.

3.3. The methodology used

Variables. In this study we aim at investigating a correlation between intelligence and emotion. The latter, as a manifestation of personality factors.

3.3.1. Description of groups

The sample was thought to be oriented as safe as possible to a valid research, with participants in the Music field. The group consisted of 17 students from the Faculty of Arts, "Ovidius" University of Constanta, specializing in Music, belonging to the two academic cycles, bachelor and master courses: Bachelor's degree Music I - 5 students, Music II - 3

students, Music III - 1 student, Master's degree Art of Musical Education I - 5 students, Art of Musical Education II - 5 students. Also, the group of participants consists of 9 females and 8 males.

3.3.2. The tools used for data collection

For the purpose of our research we have chosen three questionnaires, which, by correlation, have revealed the above-mentioned results. The procedure for applying the questionnaires was the established one. The students were summoned to a classroom and answered all the questions of the three questionnaires during the allocated time.

1. First FFPI Intelligence Questionnaire - *Five Factor Personality Inventory* - is the doctoral thesis of researcher A.A. Jolijn Hendriks, of the University of Groningen (Netherlands), having as coordinators, professors W.K.B. Hofstee and B. de Raad. The questionnaire has 100 items grouped in five scales, named after one of the superfactors: Extraversion (E), Kindness (K), Conscientiousness (C), Emotional Stability (ES), Autonomy (A). Relying on the purpose for which it was designed, the diagnosis of personality in the educational field, we have considered it a precious tool in the present research and applied it to the group of participants.

2. The second test applied and presented in our research is I-S-T 2000 R - *Intelligenz - Struktur - Test 2000 R - The Intelligence Structure Test*. It comprises two parts that highlight different stages of the human intelligence: verbal intelligence, numerical intelligence, figurative intelligence, and in part B crystalline intelligence and fluid intelligence.

3. The third questionnaire belongs to the researcher of this study. It sums up 15 structured questions on the work *The Prelude to Unison*, in *Suite I*, op. 9, in Do, by George Enescu. The questionnaire includes questions about the elements of language and stylistics of the paper.

3.4. The research

The participants were tested with the emotional stability scale and the ISTB numeric skill scale. We have chosen the numerical skill scale because it was the closest to the term of musical thinking. The reading of musical scores requires skill, accuracy, logical thinking that are found as processes in the numerical knowledge scale, *nk 3*.

	St	Std
	atistic	. Error
s	64	2.4
tab	.94	40
Mean		
Lower	59	
95% Confidence Bound	.77	
Interval for Mean		
Upper	70	
Bound	.11	
5% Trimmed Mean	64	
	.99	

	Median		63	
			.00	
	Variance		10	
			1.184	
	Std. Deviation		10	
			.059	
	Minimum		49	
	Maximum		80	
	Range		31	
	Interquartile Range		18	
	Skewness		.1	.55
			18	0
	Kurtosis		-	1.0
			1.239	63
	Mean		5.	.25
			47	9
		Lower	4.	
	95% Confidence	Bound	92	
	Interval for Mean	Upper	6.	
		Bound	02	
	5% Trimmed Mean		5.	
			41	
	Median		5.	
			00	
k3	r	Variance	1.	
			140	
		Std. Deviation	1.	
			068	
		Minimum	4	
		Maximum	8	
		Range	4	
		Interquartile Range	1	
		Skewness	.6	.55
			10	0
		Kurtosis	.6	1.0
			34	63

Table 3.1.

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
stab	.110	17	.200*	.947	17	.417
nk3	.200	17	.070	.899	17	.640

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 3.2.

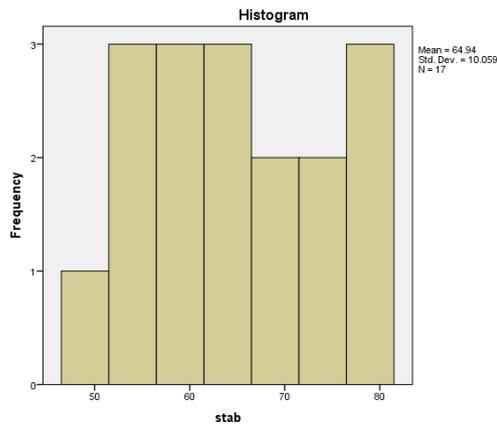


Fig. 3.1.

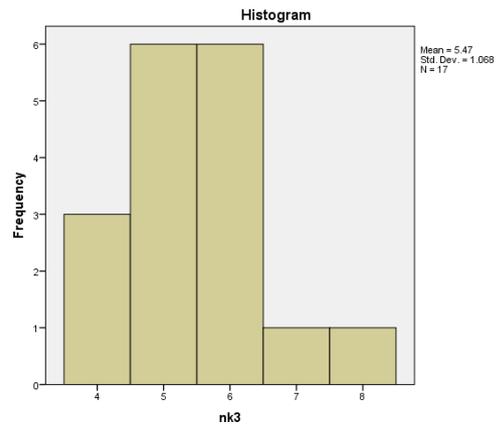


Fig. 3.2.

	nk3	stab
Pearson Correlation	.532*	
Sig. (2-tailed)	.028	
N	17	17

tab	Pearson	.5	1
	Correlation	32*	
	Sig. (2-tailed)	.028	
	N	17	

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3.3

The analysis of the correlation table shows that there is a positive correlation between the two variables at a significance threshold $p = 0.028$ statistically significant.

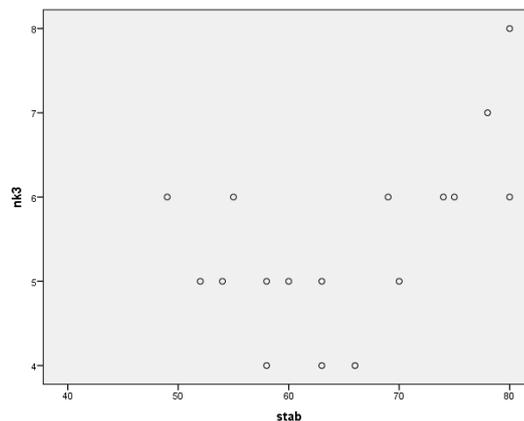


Fig.3.3

3.5. The interpretation of data

After applying the three questionnaires we have quantified the result, which confirmed the hypothesis that there was a positive correlation between the mastery of emotions and the musical thinking of the students from the Music program, the Faculty of Arts, "Ovidius" University of Constanta.

This result confirms the research in the specialized literature, which, following neuroscience investigations, demonstrated the brain bases of emotions as being at the intersection with those of cognition.

At a stage prior to neuroscience studies, emotions were anchored, in the brain, in the limbic system. Richard J. Davidson, exploring the brain in correlation with emotional intelligence, started from the premise that "superior cortical functions, especially those located in the prefrontal cortex, the most advanced phylogenetically, are crucial to emotion." (Davidson RJ, Begley S., 2013, p. 17). It is one of the researches undertaken to demonstrate that the size of the prefrontal cortex is implicitly implicated in cognition and emotion.

Every musical expression, in the compositional or interpretative act, is being built concurrently between the musical order, reflecting the thinking and the expressiveness. In the

21st century, **the musical thinking** is oriented in an ever-changing direction due to the quantitative and qualitative accumulations of the centuries of music and the incisiveness of the emergence of hi-tech communication systems and their composition with the traditional ones.

The element with which the musical thinking operates is its sound and its shadow, the silence, namely the pause. In any musical construction, involving any musical parameter (height, rhythm, dynamics, timbre), it is necessary to relate the cognitive and emotional attitudes. **The musical order** that the musician imparts to his creation is synonymous with a certain determinism. In the mind of a musician, when he creates (composing or interpreting), schemes of musical constructions are applied, which are in fact musical patterns, assimilated throughout life, through artistic education and arts: training, auditions, recitals, concerts, continuous knowledge. These specific patterns above mentioned represent the sound material, thought out and processed, the notions and concepts assimilated to the theoretical disciplines, which the artist experiences in his creation. "True thinking about music is the most natural thing to do on the land of musical intelligence and activity: on this land, a Schubert or a Brahms thought about Beethoven's creation (and testified in the sense shown by their works) ..." (Bentoiu P. 1973, p. 39). Thinking involves its form of manifestation, **the intelligence**. The American psychologist Howard Gardner has outlined a new perspective in cognitive sciences, developing the theory of multiple intelligences. The American researcher, who studied the piano in childhood and at the age of maturity, obtained the psychology degree, then obtained his doctorate at Harvard University in the field of developmental psychology, argued that people had a lot of possibilities to process the information, highlighting one, two or more types of intelligence. He structured the field of intelligence in eight types: 1. Linguistic intelligence; 2. Logical-mathematical intelligence; 3. Musical intelligence; 4. Spatial intelligence; 5. Body-kinaesthetic intelligence; 6. Interpersonal Intelligence; 7. Intrusive Intelligence; 8. Naturalistic Intelligence. The above is added to the last success of psychology, the form of **spiritual intelligence** originally challenged and accepted in the US and the UK today. It appeared in the form of a phrase and then a concept in the extensive study *Rewiring the Corporate Brain: Using the New Science to Rethink How We Structure and Lead Organizations* by Danah Zorah. The notion draws attention to the danger of devaluation of human life and anchoring in this salutary dimension for education, health, art, practically in any field in which man denotes professional activity. "According to Danah Zorah, spiritual intelligence is the superior instance of our intelligence" (Mihalache S., 2017, p. 54).

The musical intelligence, which we also refer to in this study, is the way to reflect the sensibility and abilities of the people expressing themselves with musical ease, both melodic and rhythmic. People with such intelligence are attracted from a young age to various modes of expression, either by listening or by interpreting. They are impressed by the sensory perceptions of various musical techniques: vocal, instrumental, individual (solo) or group (vocal or orchestral ensemble). They can listen to musical works, memorize fragments of different, melodic or rhythmic sizes, can easily play vocal or instrumental, and in the higher stage they can improvise, compose, or can research in the field.

Daniel Levitin, American psychologist and researcher, born in 1957, who was concerned about the musician's sensitivity and intelligence, initiated a comprehensive study materialized in the book *Our Musical Brain* (2010). He makes scientific incursions into the

human brain mechanics, revealing and developing the neural pathways responsible for human musicality. D. Levitin explains the quality of assimilating any kind of music, despite the remarkable differences between them, even at a very young age. In childhood, due to the expansion of neural networks, this musical assimilation capacity is also facilitated. In the beginning, the perception is that the eardrum is the "gate of hearing." (D. Levitin, 2010, p. 117) Then following the reception, a sorting process is carried out by specialized regions that "break down the signal into information about tonal height, timbers, spatial location, intensity, reverberating environment, the duration of the tones, and the moments of the appearance of different notes (and various tonal components)." (D. Levitin, 2010, p. 118).

At this stage, the prefrontal cortex takes the action of managing music information. It is the moment of the intervention of musical thinking, of sorting the musical information. This stage depends greatly on the amount of music stored, the previous models allowing the new ones to be compared and assimilated. D. Levitin compares this moment with that of grasping the grammatical notions specific to our culture. Neuroscience researchers attach great importance to neurotransmitters, which facilitate the transmission of nerve impulses in the two hemispheres. The same research in the field is due to the differentiation, yet nuanced, of hemispherical lateralization, each of which performing different functions. "The contour of a melody - simply its melodic form, ignoring the intervals - is processed in the right hemisphere, because it makes great differences between tones that are close as height." (D. Levitin, 2010, pp. 142-143) The same psychologist D. Levitin notes the involvement of the left hemisphere in rationality aspects.

One of the most significant studies in psychology is that of researcher Daniel Goleman, *Emotional Intelligence* (2008). He expresses a pertinent point of view on the connection between thinking and emotion. The two dimensions of concretizing these attitudes, thinking and being in excitement, are the prefrontal cortex and the tonsil and are responsible for their concretization. "So emotions matter in a reasoning the emotional capacity guides us through the decisions of the moment, working in collaboration with the rational mind, helping - or not - the thinking." (Goleman D. 2008, p. 58) He explains about self-observation, gaining control over their own thoughts, intentions and manifestations.

The emotional self-awareness allows thinking to manifest itself unaltered and evolve to a different level, that of the plenary experience of a pleasant manifestation. Constructive emotions in music are those that identify with creativity, contextually with complex but balanced musical genres and forms that meet the mathematical proportions. Emotions that are built "below the threshold of awareness can have a strong impact on how we perceive and react, even if we have no idea that they are already working." (Goleman D. 2008, p. 88).

Musical expressiveness is what attracts us to a particular genre, composer or performer. The musician, through his creation, being a mirror of his personality, builds and communicates also from his intellectual and emotional vitality. The affective culture highlighted in music denotes a skill of the creator to access from his voluminous musical baggage, the most pleasant alternatives, reported to the aesthetic principles that have been acquired and integrated. It is the neural mechanics that organizes this aspect.

The musician is, as a matter of fact, and that is demonstrated by this research, a sensitive person, who has the desire and the ability to exteriorize his emotions. The force of expressiveness with which he manifests himself in creation is doubled by the act of musical thinking. What we feel as musicians in creation and interpretation is proven in psychology

and interdisciplinary studies, according to which only a harmonization of cognitive and expressive act can reveal authentic artwork. "The new paradigm urges us to harmonize the mind and the soul." (Goleman D. 2008, p. 58)

The same study by psychologist Richard J. Davidson and the previously mentioned journalist Sharon Begley (*Brain and Emotional Intelligence*) helps us locate the brain bases of emotions and decrypt their significance. Their studies have revealed that the point of view of localizing emotions exclusively in the limbic and hypothalamic system is overcome, but the prefrontal cortex is responsible both for superior functions as well as for the control of emotions. They draw attention to the human personality that identifies itself with a set of "superior qualities that include specific emotional traits and emotional styles." (Davidson J.R., Begley S. 2013, p. 12).

The result of their research has revealed six Emotional Styles, fundamental categories, which are found in each of us, most of the times, in combinational formulas: Resilience, Perspective, Social Intuition, Self-consciousness, Context Sensitivity, Attention. These Emotional Styles, being the result of brain patterns, demonstrate how primordial the emotions are in building our identity. Differential brain location is one of the hypotheses proposed and demonstrated by the study of psychologist Davidson R.J. "We have thus found one of our first indications according to which the right hemisphere may be more active in negative emotions than in positive ones." (Davidson JR, Begley S. 2013, p. 51) Thus, the results of his research, performed on different groups of babies or adults have revealed that in the case of positive emotions, the left hemisphere is activated and in the case of the negative emotions, the right hemisphere is activated. He reveals that the movement of the eyeballs in a certain sense reveals the activated hemisphere in the manifestation of emotions.

Conclusions

The two psychic processes, emotions and cognition, are distinct and are treated separately in the fundamental field of Psychology. But their importance in the architecture of the personality of a musician, in the reception and production of the musical act, is significant and, as a result, they are two interdependent processes that help shaping the artistic act. The brain structures involved in the cognitive processing of information influence emotions and vice versa.

The emotion that we are capable of in interpreting a musical work is due to a long work of assimilation, fixation and rendering, involving the neural networks built during the study, and the handling of that sound material, fixed by musical thinking, with its own means relating to personality factors, the amalgamation of the six emotional styles defined by Richard Davidson. He also defines the same headquarters of the human brain, the prefrontal cortex, as being responsible both for the manifestation of thought and emotion, "and that in fact the barricade that psychology has raised between reason and emotion had no basis." (Davidson JR, Begley S. 2013, p. 63)

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MIREA, R. *Methacomunication in Conductor's Art*, Bulletin of the Transylvania University of Brasov, Series VIII, Vol. 9 (58). Nr. 2. 2016.