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MUSIC

1. EMOTIONS IN MUSIC AND THEIR IMPACT ON THE EMOTIONS OF PERCIPIENTS: RESEARCH ON HUMAN VOICE AND SINGING

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Abstract: *The field of psychology of singing is the least examined area so far, so in the research study we present the research survey from the field of human voice and singing. Music allows the access to the experience of emotions, which can then manifest itself in various changes at a psychosomatic level. New research findings can therefore be used very effectively in the field of music therapy or singing. The anthropological idea of this phenomenon is based on the fact that the human voice is an extremely sensitive physical and emotional tool through which it is possible to act on the body, psyche and spirit, in terms of complex personality development and to discover human contact with its deeper, archetypal components. The sound experience of singing can touch a person's most basic existential experiences. In this study we want to reveal the underappreciated possibilities of using the human voice and singing in the field of music therapy and point out the purposeful development of vocal dispositions, in concord with the core of human personality (conscious and unconscious). Mainly owing to strong emotions, it has a significant impact on harmonisation of hemispheres, stimulation of all mental functions that leads to spontaneous revitalisation of the psyche and body and it subsequently leads to improved quality of life.*

Key words: *emotion, mood, auditory perception, human voice, singing, music therapy, music experience*

1. Introduction

Emotion is one of the omnipresent aspects of human existence that relates to virtually every aspect of human behaviour – action, perception, memory, and decision making. Despite that, the study and research of emotions was pushed to the background, while the study of "higher" forms of mental processes was preferred. Psychologists emphasize that emotional processes are an integral part of our decision-making and are not limited to the subterranean brain structures. The area of artistic emotions is very confusing though. The current psychological approach to music and emotions searches to explain why we experience emotional reactions to music, and how and why we experience music as something that expresses emotions. It also tries to understand the mechanisms which intervene between the music captured by our hearing and the emotion a person experiences as the result of hearing that music. It is not enough merely to define the lawful relationships between music as a stimulus and emotion as a reaction.

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2. Related words and synonyms for clarifying – emotions in music

In the scholarly literature, the following terms are often confused – affect, emotion, mood, feeling, excitement (ecstasy). K. Oatley and J. M. Jenkins (1996) state that **affect** is more general than emotion and mood. Many authors believe that affect is phylogenetically and ontogenetically primary in terms of emotion and mood. **Emotions** are considered different from moods in the following:

a) emotions are considered short, while moods last for a longer time,
b) emotions have usually an identifiable stimulating event versus mood,
c) emotions are accompanied by clear facial expressions, moods are not (Batson, 1992).

R. J. Davidson (1994) sees the difference between emotions and **moods** in their function. He notes that emotions emphasise "action" – move us doing something, while moods emphasise "cognition" because they tend to shift the processing of information in a way that can affect memory, decision-making, and evaluative attitudes. **Excitement** is often considered an important aspect of emotional reactions, and it is often used in descriptions associated with music and emotions. Sometimes it is used more generally and refers to the level of emotional intensity of the reaction, other times it refers exclusively to the activation of the nervous system. The relationship between these two meanings is not clear. It has been proven that people can feel intense emotion without a visible sign of excitement. At first side, **musical emotions** can be divided into two groups:

1. Emotions related to the aesthetic value of music.
2. Emotions expressed by music which are separated from the aesthetic value of music.

3. Emotional reactions to music in research

It is difficult to explain emotional reactions to music in the context of existing theories of emotions. Despite that music is considered an excellent means to the study of emotions. The main goal is not the identification of emotional phenomena, but their functionality. Emotions as a subject of research can be deduced from the descriptive information of the individual, from expressive behaviour as well as from physiological measurements. The results of psychophysiological research on the physiological manifestations of emotions confirm that emotions are accompanied by various physiological changes (for example the acceleration of heart rate and respiration, heart rate, ECG, EEG, skin resistance, blood pressure, and others).

Although it is very difficult to distinguish the physiological correlates of specific musical emotions, it has been possible to find differences between the emotions of anger, fear, and finally sadness and happiness. However, these results are still being verified. Verbal evaluations of perceived emotions and physiological measurements were compared, not within the whole composition, only in short segments. The sections with the **emotion of sadness** in music caused the biggest changes in heart rate, blood pressure, skin conductivity and skin temperature. The sections with the **emotion of fear** caused the biggest changes in the speed of blood flow and its amplitude, while the **emotion of happiness** caused the biggest changes in the speed of breathing. A new approach to the research of

emotional reactions is brought by neurochemistry, it examines the processes associated with the excretion of substances – endorphins and cortisol, which have impact on the nervous system.

The most common way to measure emotional responses in adults is via questionnaires or free descriptions. The choice of the appropriate words to the scale remains a problem. Many changes can occur without emotions, so it is difficult to determine the exact relationship between emotional condition and physical reaction. Problems also arise when using expressive behaviour, which can also occur without emotions, because people use it for communication. There exist many studies that provide the evidence of experiencing emotions associated with music. An interesting example is the phenomenological analysis of musical experience (Pike, 1972) in which musically untrained people listened to a music demonstration for 5 minutes to verbally capture their reactions to the music heard. Through content analysis, their information was reduced to a set of co-experienced factors, listed according to the frequency of occurrence:

a) feeling of joy (96%),
b) perception of stable moods (86%),
c) feeling of oneness with music (83%),
d) perception of spontaneous and transient states (72%),
e) feeling of movement (65%).

The results indicate that emotional responses to music include stable moods, passing emotions, and the feelings of joy. There is an ample evidence of the listeners' expressive behaviour as well as many physiological changes when listening to music. In this context, it is important to state that emotions are induced and appear not only as a stimulus, but above all as an act through their meaning, positive or aversive essence. The part of what looks like an emotional response to music is not accompanied by any knowledge of what it means. Research confirms that people often receive emotional information automatically or subconsciously. J. LeDoux (1996) described a neurophysiological system consisting of parallel mechanisms or modules of susceptibility that responded to simple acoustic stimuli. This system of perception shows how emotions can be evoked not on a conscious level. This means that the implicit perception of emotional expression in a piece of music can affect us emotionally, although we will not be aware of this process.

Another group of implicit stimuli is the one that gains an emotional charge through similar features that the individual no longer remembers. Even musical stimuli can evoke strong emotions through conditioned reactions, the origin of which we do not remember. The issue of emotions can also have social connotations. Identifying the emotions that other people experience is often a priority for us, not to join them in expressing their emotions, but to see how they will respond. Music has certain qualities that tend to attribute emotions to it. In terms of intensity, the emotions that percipients experience when listening to music are equivalent to the emotions they experience in real life. Under certain circumstances, the musical emotions of these people led to a significant personal change. J. Sloboda (in Franěk, 2005) points out the fact that music neither creates nor changes emotions, but rather allows access to the experience of emotions that a person already experiences at a certain level, but which he is not aware of or

cannot develop himself/herself.

Our reactions to music vary in depth, sometimes we just identify or observe the emotions in the music without experiencing them, other times strong and authentic emotions can appear spontaneously. It is interesting that repeated listening to the work does not reduce the impact of certain musical-structural steps and we perceive the work for the first time. Franěk (2005) presents three ways in which music expresses emotions:

1. Structural expectations – approaching the point of stability.
2. Feel the decreased/increased tension in the field of tonality, rhythm, metro.
3. Musical expectation also plays a key role, according to the laws of which we strongly respond not only to unexpected and unheard musical procedures, but also to expected, typical procedures. Thus, the emotional response is based on two opposite opposites.

Based on a summary of the research results of 1935-1999, we present a summary of the relationships between the elements of compositional structure and emotional expression. Despite the indicative significance of such syntheses, it turns out that there is an **emotional communication code** that is understandable to both musicians and non-musicians. The results of the P. N. Juslin and J. N. Juslin (2001) studies are in a two-dimensional emotional space (feelings of tension – relaxation, surprise or confirmation of expectations have one emotional dimension, greater or lesser intensity of reaction, therefore they do not form full-fledged emotions), they are formed by valence axes and activity levels.

Feedbacks that have only one emotional dimension of "proto-emotion" (according to Sloboda and Juslin 2001) tend to grow into full-fledged emotions by adding additional mental activity within the perception, for example evaluation of the meaningful content of music. This shift depends on the other two external sources of emotions in music – episodic and iconic associations. It turns out that in researching emotions in the context of music psychology, a dimensional approach is more appropriate than a categorical approach, which defines emotions using a space made up of several dimensions, most often by the dimensions of valence (good-bad, pleasant-unpleasant), potency (strong-weak), and activities (active-passive).

A **strong musical experience** is seen by humanistic psychology (A. Maslow) as one of the characteristics of an individual's self-actualisation or self-realisation. It is also interesting to divide the reactions and internal states experienced by the percipient into six categories: bodily reaction, perception, cognition, emotions, existential or trenscendental aspects and personal development. In singing, human soul appears most distinctly. Intense singing is usually associated with positive mental and physical reactions. Singing releases mental blocks and sets in motion the body's self-healing process. When a person deeply experiences the "recognition" of his body, then the emotions of joy, faith and trust are awakened in him. The larynx does not exist only as a separate organ, but it is integrated into the whole human body.

Furthermore, it was found out that the perception of height is based on vocal muscle sensation, the perception of colour with kinesthesia of the articulatory apparatus. The motor and vocal basis of pitch perception is thus associated with

the simultaneous innervation and the activity of the vocal system. These are the processes of proprioceptive, reverse afferent processes. Impulses from the laryngeal muscles pass to the locomotor centers in the cerebral cortex (kinesthetic analyser).

Although not all parts of the vocal system are accessible to will control, it is possible to learn how to control breathing (muscle) movements, laryngeal and articulation, based on the principle of ideomotor skills. The living idea corresponds to micro-movement, activity. In beginners, auditory control predominates, until later a bound is formed between auditory control and muscle tension. It is good if the singer develops both auditory and muscular control. By measuring these micro-movements using instrumental techniques, it was found out that even the percipient "sings internally" together with the singer, holding his breath for long phrases.

Even in this case, the muscles help hearing. When the singer sings, he also hears his vocal expression, acquires kinesthetic ideas about the work of the vocal apparatus, feels various vibrational phenomena, has a special internal scheme of vocal "sounding", for example the sound begins to vibrate in the area of the top of the head, chest, it is felt at the teeth, and others. After isolating the auditory control, the singers regained the ability to sing correctly by feeling the vibrations of the device. Thus, it is clearly proven that singing settles and the muscles that control the vocal cord tension more strongly, while the movement and tension of the vocal cords coincide with auditory pitch control.

The singer can hear the vocal cords. The bronchi and trachea are not only the site of compression but are also the resonant organs. The cause of impure singing is very often colour because the singer is heard not only through the external air environment, but also through the internal one (muscular, vibrating, and resonant moments). There may be a lack of image in the inner ear. The voice is primarily controlled by the hearing, not the larynx. Hearing loss can affect not only the ear but also the voice. The question of the acoustic theory of vowels is very interesting in this context. It is found that for each vowel there are so-called formant regions, such as for vocal "a", which has a formant of 768 Hz, the resonant formant region is 683-861 Hz and the second higher band is 1024-1366 Hz. The above findings point to the possibilities of sounding individual vocals and their favorable conditions in some positions (therapeutic use). Singing therapists have come to the realisation that when each sound occurs, an activity occurs in the air in a specific way that affects the organs and functions of the whole organism.

Hearing is of great importance for human development, because according to V. Marek (2003) in the prenatal period of human fetal development, hearing from the senses develops first and disappears last. The mother's voice already affects her embryo, which perceives it through the resonance of bones and body tissues. The sound participates in the formation of the structure and shape of the nascent fetus in individual developmental stages. As sound propagates in water five times more efficiently and faster than in air, auditory sensation is greatly enhanced. These internal sound manifestations form our first sensory experience, the sound archetype that shapes the verification standard of our future consciousness.

The sound spectrum of high quality voices has two main maxima – the first, deep (formant area of the vowel "a") and the second maximum, high (vowel area "I") around 3000 Hz – the voice gets shine, the color is brightened, but also "o" and "u". There individual colour of the voic is affected by mental regulation. The field of psychology of singing is the least elaborated area, and little research is devoted to the significance of individual psychological differences in singers, analysis of individual psychological processes, personality traits of the singer, creativity, imagination training and imagination, emotionality as an experienced relationship to reality. Relaxation and joy are an energetic, mobilizing forces. Emotions are connected to subcortical area actively connected to the autonomic nervous system that has its reflection in voice, changes color, expression and the peculiarities of temperament in singing (ability to regulate behaviour, explosiveness, and aggression). Sanguinism and cholericism -ismus occurs in both high voices and tenors. Phlegmaticism is characteristic of baritone and bass.

This issue strongly affects the work of the choir conductor, for whom it is very important to know the relationship between voice and emotions. Thanks to the correct use and direction of emotions, the conductor can change the mood, the color of the voice, which significantly affects the physiological processes in the body as well as the quality of singing. The conductor should understand the psychology of the members of the choir, know how to unite their various characteristics into a harmonious whole. In addition to the authority of the conductor's personality, the emotional setting of the people in the choir is also influenced by the sung work with its emotional charge, the entire psychophysiological process of the singing itself and the accompanying neurochemical processes stimulated by music.

Although we do not yet know which processes occur specifically during singing, it is known that evoked emotions and positive mood are related to the autonomic nervous system which controls basic biological functions, not subject to intellect (blood flow, change of galvanic skin resistance and skin biological reactivity, blood sugar, sweating glands, muscle tension, blood circulation, pulse, breathing, body temperature, digestion, increased levels of natural opiates – endorphins, effects on the immune system, brain, physical endurance). A. J. Blood et al. (2001) report that the striatum in the basal ganglia receives (along with the lymbial system and prefrontal cortex) nonadrenaline (for enthusiasm and motivation), dopamine (motivation, movement) and serotonin (silence). Dopamine is activating and stimulating the pre-motor cortex which indicates curiosity and is associated with the system responsible for processes aimed to search and is therefore associated with musically induced movements and stimulation induced by changes in music.

The transfer of opioids in the nuclens accumbens has been linked to the release of dopamine in the ventral tegmental region. Dopamine is also an active part of the mesolimbic pathway, which is activated when listening to music. The association of opioids with the mesolimbic pathway and its activation when listening to music confirms the effect on pain regulation (Menon and Levitin, 2005). Striatum-activated serotonin is responsible for sequential movement, which explains why we like rhythmic music, rhythmic moving and dancing. It turns out

that some of the emotions evoked by music can be partly explained by the meaning of the striatum. The rhythmic quality of music appears to be one of the indicators of our positive attitude towards music (Vickhoff, 2008).

In 2004, D. T. Kenny and G. Faunce published the results of research into the impact of group singing on mood, coping, and pain. Improved mood, coping and reduced pain were confirmed. The research has further highlighted the therapeutic importance of choral singing for a wide range of physical, neurophysical and psychosocial problems as well as the supporting role of music in relieving pain and reducing stress and tension. The active singing group showed a strong influence on the experienced chronic pain. The group of listeners also showed a significant reduction in the experience of chronic pain. Thus, research has clearly confirmed an improvement in mood, a pain management, and a pain reduction. In 2004, an article was published in the Journal of Behavioral Medicine (in: Kenny, Faunce, 2004) by a team of researchers from Goethe University in Frankfurt on the effect of choral singing or listening on the secretion of immunoglobulin A, cortisol and emotional state. While cortisol levels did not change significantly, secretory immunoglobulin A levels in singers increased significantly after choral singing testing. Secretory immunoglobulin A is an important substance in our immune system, responsible for the body's defense mechanisms.

In 2006, a research team from Lawrence University in California (in Kenny, Faunce, 2004) repeated similar research with solo singers. They focused on differences in secretory immunoglobulin A and cortisol levels during training and performance. It was confirmed that before and after exercise and withdrawal, the level of secretory immunoglobulin A increased, but after withdrawal it was significantly higher than after exercise and the level of cortisol (an indicator of stress) also increased, while the level of cortisol decreased after the test (fear of failure was eliminated), therefore the stress level is lower. Other studies provide information on the positive impact of singing compared to classical relaxation on lung function in asthmatics. Learning the right breathing technique is also regular breathing training, which in conjunction with muscle function can act on us as a muscle-breathing exercise, which is important for the relaxation of tense muscles and the whole body. Neurochemical and neurohormonal activity of singing refers to the possible beneficial effect on the survival of pain and the body's immune system, along with respiratory and muscle training as well as the respiratory and muscular system.

4. Research of emotions in music in Slovakia

Method: In her research in Slovakia, A. Moravčíková (2008) used a method of questionnaire with items that dealt with the two factors of perceived benefits – emotional and physiological. To measure the current and constitutional mood, she used an abbreviated version of The POMS Questionnaire (The Profile of Mood States Questionnaire), which is also used in the above-mentioned foreign research.

The research sample consisted of two main groups. The first consisted of the members of three choirs: the female choir of the University of Prešov in Prešov, the mixed choir of the University of Prešov in Prešov and the choir of the

Collegium Technicum of the Technical University in Košice. A total of 56 choir members aged from 18 to 44 with an average age of 23.92, of which 34 were women and 22 men, mostly undergraduate students. The aim of her research was:
1. Identify significant differences in mood and anxiety measured in the members of singing choirs before and after the choir rehearsal.
2. To verify the perception of singing by the members of choirs from the point of view of the positives in their emotional state, and well-being and other selected health areas, especially on respiratory and muscular activity and on the immune system.
3. To determine whether singers from choirs are considered more subjectively healthier than the common population.

In this contribution we introduce a few results: By testing the normality for the overall score, we found that the scales of anger, confusion, sadness, fatigue, and tension from the BRUMS mood questionnaire did not have a normal distribution. For the vitality scale from the BRUMS mood questionnaire and the anxiety scale from the STAI questionnaire, we found a normal distribution.

Therefore, we used the analysis of variance by the Wilcoxon nonparametric test for two independent selections to compare the pre and post test scales of anger, confusion, grief, fatigue, and stress, and we used a T-test to compare pair averages to compare the pre and post test scales of vitality and anxiety. Significant differences were found on four of the six BRUMS scales (anger, disconcert, grief and tension) and on the STAI anxiety scale. There was not found a significant difference in the scales of fatigue and vitality.

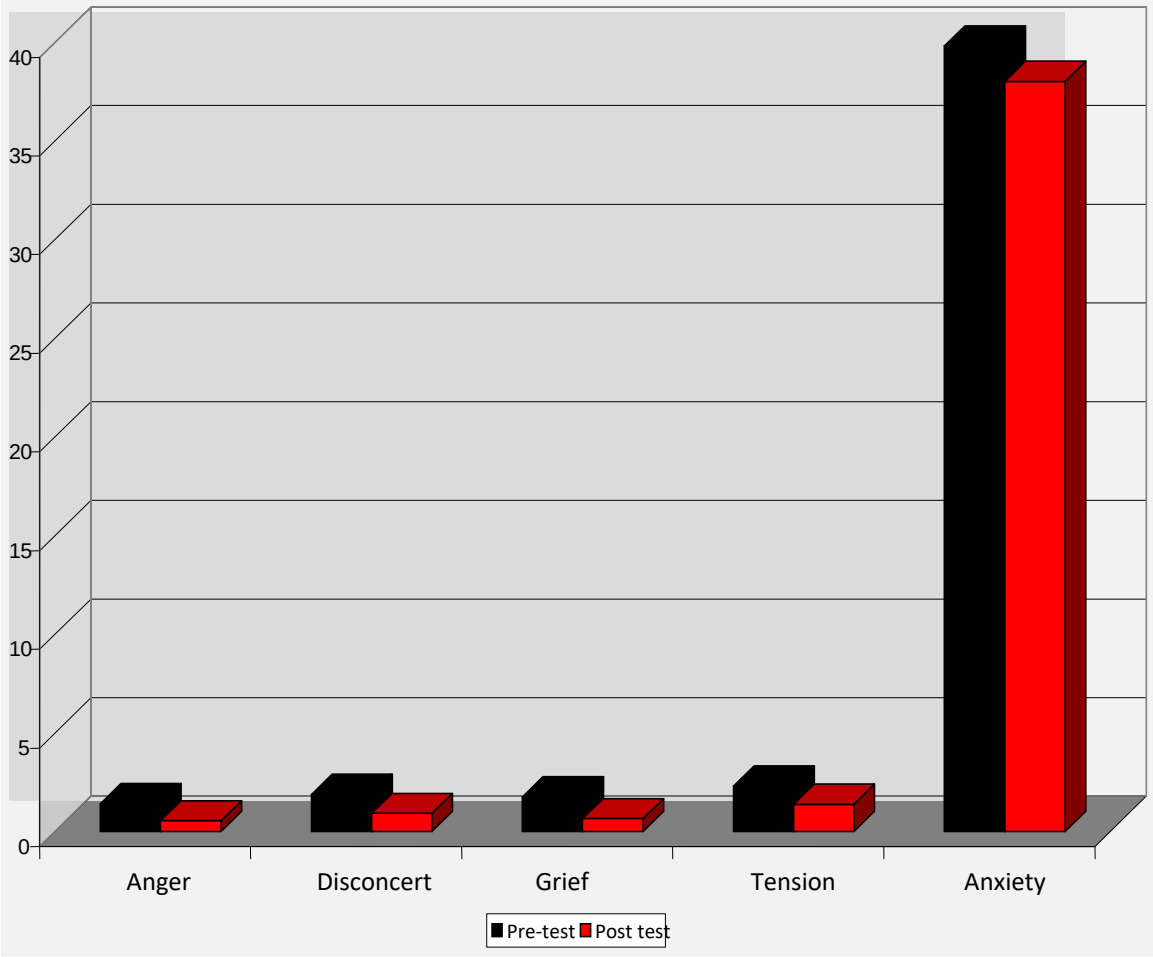

Figure 1. Anger, disconcert, grief, tension and anxiety after a choir (Moravčíková, A., 2008)

Table 1. The results of analysis of variance for variables: anger, disconcert, grief, fatigue and tension before and after church rehearsal (Moravčíková, A., 2008)

N=48	Anger post test - Anger pred test	Disconcert post test - Disconcert pred test	Grief post test - Grief pred test	Fatigue post test - Fatigue pred test	Tension post test - Tension pred test
Z	-2.811	-3.622	-4.259	-.777	-3.828
p<	.005	.000	.000	.437	.000

Z = critical test value, p = significance level, significant results highlighted

Table 2. The results of t-test for variables: vitality and anxiety before and after choir rehearsal (Moravčíková, A., 2008)

N=48	St. deviation	t	df	Sig. (2 tailed)
Vitality pretest – Vitality post test	3.40	.757	48	.453
Anxiety pretest - Anxiety post test	5.42	2.291	47	.027

St. deviation = standard deviation, t = critical value of the test, df = degree of freedom, Sig. (2 tailed) = significance level, significant results are highlighted

By testing the normality for the total score, we found out that the only scale with a normal distribution was vitality scale. Therefore, we used the T-test for two independent selections and the non-parametric Mann-Whitney U test for the other mood and anxiety scales to analyse this scale between the members of and the comparative sample. Here was shown a significant difference on the five scales of the BRUMS mood questionnaire, by comparing the averages, in favour of the current condition of the members of the choirs after the choir rehearsal.

Table 3. Analysis of variance for variables: anger, disconcert, grief, fatigue, tension and anxiety. Comparative sample (N = 52) – singers after choir rehearsal (N = 49) (Moravčíková, A., 2008)

	Anger	Disconcert	Grief	Fatigue	Tension	Anxiety
U	571.000	428.000	603.000	1248.500	619.500	1265.000
Z	-5.152	-5.959	-4.878	-.174	-4.520	-.048
p<	.000	.000	.000	.862	.000	.962

U = test criterion, Z = test criterion, p = significance level

Table 4. Analysis of t-test for variable vitality. Comparative sample (N = 52): singers after the choir rehearsal (N = 49) (Moravčíková, A., 2008)

	t	df	p
Vitality	-2.030	99	.045

t = test criterion, df = degree of freedom, p = significance level

The statement singing “improves mood” was rated the most positive and the statement singing “helps prevent the flu” was rated the most negative of all the statements. Both results are consistent with the findings of C. M. Clift and G. Hancox (2001), where the statement singing “improves mood” was rated the most positive and the statement singing “helps prevent the flu” as the most negative.

Also, the distribution of other statements of A. Moravčíková (2008) is relatively identical with the results of C. M. Clift and G. Hancox (2001). With exception of two statements, singing "strengthens the diaphragm" and singing "stimulates adrenaline".

In the first case, in C. M. Clift and G. Hancox (2001) this statement was rated with a lower rating than in A. Moravčíková (2008). She found out 43.1% strong agreement, 45.1% agreement and 11.8% uncertainty about the statement. For this statement in C. M. Clift and G. Hancox (2001), there was 18% strong agreement, 54% agreement, 26% uncertainty and 2% disagreement. In the second case, the statement singing "stimulates adrenaline" there was evaluated much more negatively in Slovak research than in C. M. Clift and G. Hancox (2001). They had 35% strong agreement, 42% agreement, 15% uncertainty, 6% disagreement and 2% strong disagreement for this statement. In Moravčíková (2008), it was 17.6% strong agreement, 39.2% agreement, 37.3% uncertainty, 5.9% disagreement for this statement, and there was not found strong disagreement.

Frequency analysis of individual items in the questionnaire of perceived benefits of singing by A. Moravčíková (2008) confirmed that the members of Slovak choirs perceive singing as beneficial in the area of well-being and relaxation, breathing and body posture, and the heart and immune system. Especially when it comes to well-being and relaxation and breathing and body posture. The most positive item was the singing "improves mood". What is surprising in theory, on the other hand, is the worst rated item "helps to prevent flu" as well as the assessment of whole heart and immune system, as according to the relevant literature, singing should have very positive impact on human health and immune system. Similar surprising results were obtained by C. M. Clift and G. Hancox (2001), who, given the literature on the positives of singing to the immune system, also assumed a higher rating in this area. However, it was found out that singing was evaluated beneficially in the research of A. Moravčíková (2008), and the distribution of the data largely confirms the results of C. M. Clift and G. Hancox (2001).

5. Conclusions

The benefit of the mentioned research verifications is the confirmation of the results of previous studies done with the research data from Slovak population, and the sketching of several debatable questions in this unexplored field. We also consider this to be a benefit for music therapy, where music has been used for a long time to regulate emotional experience and well-being, and despite that it still does not have a solid objective statistical basis.

The mentioned research represents a contribution to further approach and to a deeper understanding of the processes that take place in the interaction of a human being with singing, in connection with his or her emotional and physiological health.

Sound, voice and singing are relaxing, they stabilise the mental physical and emotional condition, allow to reach a condition of deep concentration, help build a sense of anticipation, serve contemplation, help develop interpersonal communication, creativity, transfer the flow of energy from the left – analytical

hemisphere to the right – holistic, ituitative, which ultimately brings the growth of consciousness to a higher level of being, the ability to uncover and understand the meaning of life.

References

1. Batson, C. D. (1992). Differentiating affect, mood, and emotion. In: Review of personality and social psychology. P. 294-326. Newbury Park, CA: Sage
2. Blood, A. J. (1999). Emotional responses to pleasant and unpleasant music correlate with activity in paralimbic brain regions. In Nature Neuroscience, vol 2, no 4. pp. 382-387
3. Clift, S. M. & Hancox, G. (2001). The perceived benefits of singing: findings from preliminary surveys of a university college choral society**.** The Journal of the Royal Society for the Promotion of Health, Vol. 121, No. 4, 248-256 (2001)
4. Davidson, R. J. (1994). The expression of the emotions in man and animals. London: John Murray
5. Franěk, M. (2005). Hudební psychologie. [Psychology of music]. 2005. Praha: Karolinum
6. Juslin, P. N. & Sloboda, J. N. (2001). Music and Emotion: theory and research. New York: Oxford University Press
7. Kenny, D. T. & Faunce, G. (2004). The impact of group singing on mood, coping and perceived pain in chronic pain patients attending a multidisciplinary pain clinic. Journal of Music Therapy 2004; XLI (3): 241-258
8. LeDoux, J. (1996). The emotional brain. New York: Simon & Schuster
9. Marek, V. (2003). Hudba jinak. [Music differently]. Praha: Eminent
10. Menon, V. & Levitin, D.J. (2005). The rewards of music listening: Response an physiological connectivity of the mesolimbic system. Neuroimage. Vol. 28. No 1. 175-184
11. Moravčíková, A. 2008. Vplyv zborového spevu na vybrané emocionálne stavy a subjektívny pocit zdravia. [Impact of choral singing on the selected emotional conditions and subjective wellbeing]. Prešov: FF PU. Diplomová práca
12. Oatley, K. & Jenkins, J. M. (1996). Understanding emotions. Oxford, UK: Blackwell
13. Pike, A. (1972). A phenomenological analysis of emotional experience in music. Journal of Research in Music education. 20 p. 262
14. Sloboda, J. A. (2000). Musical performance and emotion: Issues and developments. In: Music, Mind, and Science. Seoul, Korea: Western Music Research Institute
15. Vickhoff, B. (2008). A Perspective Theory of Music Perception and Emotion. Doctoral dissertation, University of Gothenburg, 2008